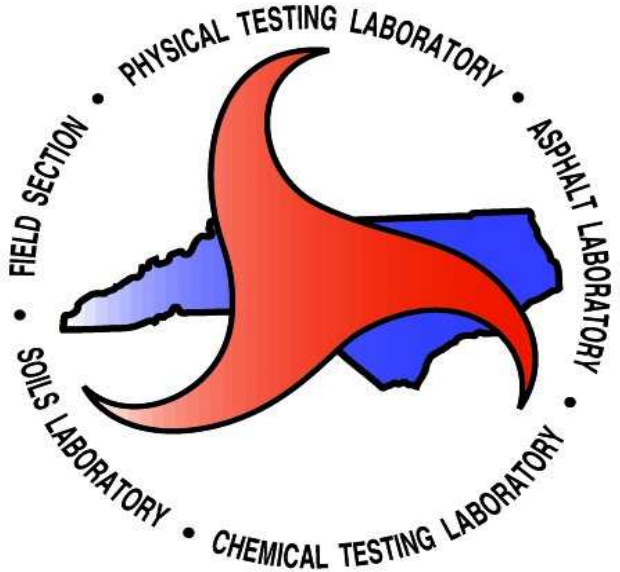
2010 version

Materials & Tests Unit



NCDOT

BORROW PIT SAMPLING SCHOOL

Section 1

PURPOSE OF THIS SCHOOL

- To explain the techniques for obtaining soil samples from a proposed borrow pit.

WHY IS A BORROW PIT USED?

- A borrow pit is generally utilized by the Contractor when a project requires a larger amount of fill material versus amount of usable material obtained from cut sections. Due to the various soil types in North Carolina, a proposed borrow pit must be sampled and tested for approval. Samples taken from a proposed borrow pit must be obtained by project personnel having a valid Borrow Pit Sampling Certification.

SECTION 2
IMPORTANCE OR PROPER SAMPLING

- A sample is defined as a “portion, piece, or segment that is representative of a whole”.
- It is therefore important that the procedure(s) used to obtain this small portion not compromise the requirement that it be representative of the larger portion.
- Each borrow pit sample will be taken to a NCDOT laboratory and tested for soil classification.
- The soil classification is utilized to determine if the soil has the desired engineering properties (i.e. load-carrying capacity).

PROPER SAMPLING PROCEDURES

- Unsuitable soils placed in an embankment or subgrade may cause structural failure in the roadway leading to costly maintenance repairs; therefore, following proper sampling procedures can not be overemphasized.

- The **NCDOT Construction Manual** can provide guidance when sampling a proposed borrow pit or, during the construction phase, provide guidance when excavating soil from the pit. Project personnel should become familiar with Divisions and/or Sections listed in Table 1.

Classification	Reference Division
Materials (borrow sampling)	Division 10 (pp 10-21 thru 10-23)
Earthwork (borrow excavation)	Division 5 Section 230

Table 1

- The **NCDOT Standard Specifications for Roads and Structures** can also provide guidance when sampling a proposed borrow pit or, during the construction phase, provide guidance when excavating soil from the pit. Project personnel should become familiar with sections listed in Table 2.

Classification	Reference Section
Borrow Material (sampling)	Section 1018
Borrow Excavation	Section 230

Table 2

- Project personnel should also review the Project Special Provisions for any items that may influence the sampling and/or excavation of a borrow pit.

SECTION 3
AASHTO CLASSIFICATION SYSTEM

- The American Association of State Highway Transportation Officials (AASHTO) has adopted a standardized method for determining soil classification or AASHTO classification.
- Soils are grouped by the same general load-carrying capacity from the best being A-1 to the worst being A-7.
- For example, an A-2 soil may contain material that makes it inferior to a specific A-5 soil.
- A Group Index number is used to designate the load-carrying capacity within the same AASHTO classification.

FOR EXAMPLE:

AN A-4(5) AND A-4(20) HAVE THE SAME CLASSIFICATION, HOWEVER THE GROUP INDEX NUMBER INDICATES THAT A-4(5) SOIL HAS THE GREATER LOAD-CARRYING CAPACITY

BRAIN TEASER

IF A SOIL CLASSIFICATION REPORT SHOWS THAT ONE SAMPLE IS AN A-7-6(18) AND THE THE OTHER SAMPLE IS AN A-2-4(0), WHICH SOIL HAS HIGHER LOAD-CARRYING CAPACITY

ANSWER A-2-4(0)

➢ To determine AASHTO classification for a particular soil, several tests must be performed.

AASHTO T-88 **-** the overall distribution or "gradation" of particle sizes

AASHTO T-89 **-** determines the Liquid Limit (L.L.) of the soil.

AASHTO T-90 **-** determines the Plastic Limit (P.L.) and the Plasticity Index (P.I.) of a soil.

AASHTO T-88
PARTICLE DISTRIBUTION

- For this AASHTO soil test, two different test methods must be utilized.

- The first method measures the distribution of coarse and fine sand by screening a representative sample over specific sieves to determine the percent passing each sieve.

- The second method measures the distribution of fine particles such as clay or silt by using a hydrometer.

- The hydrometer test relies on the general concept of how quickly different soil particles settle when placed in a solution of water.

- For example, when soil is placed in a container with water and the mixture is agitated, the sand will settle to the bottom of the container first followed by the silt and finally the clay particles.

FIRST METHOD

PARTICLE SIZE ANALYSIS


SECOND METHOD
HYDROMETER

The Liquid Limit, Plastic Limit, and Plasticity Index.

Are commonly referred as:

Atterburg Limits

- AASHTO T-89 is performed to determine the Liquid Limit (L.L.) of the soil.

- The Liquid Limit is defined as the moisture content where the soil passes from the plastic state to the liquid state.

- A high Liquid Limit indicates a high clay content and low load-carrying capacity.

- AASHTO T-90 is also performed to determine the Plastic Limit (P.L.) and the Plasticity Index (P.I.) of a soil.

- The Plastic Limit is defined as the moisture content at which the soil changes from a semisolid state to a plastic state.

- Load-carrying capacity of a soil increases rapidly below the Plastic Limit and decreases rapidly above the Plastic Limit.

The Plasticity Index is defined as the numerical difference between the Liquid Limit and the Plastic Limit. Refer to the formula given below.

$$P.I. = L.L. - P.L.$$


LIQUID LIMIT


PLASTIC LIMIT

- The general concept behind the Atterburg Limits tests relies on the reaction soil particles have with water.
- Depending on the type and amount of particles in a given soil, different states of consistency will exist based on the amount of water within the soil.
- Figure 1 graphically demonstrates these differences as water is added or removed. Refer to the glossary provided in the back of this manual for definitions of the terms in Figure 1.

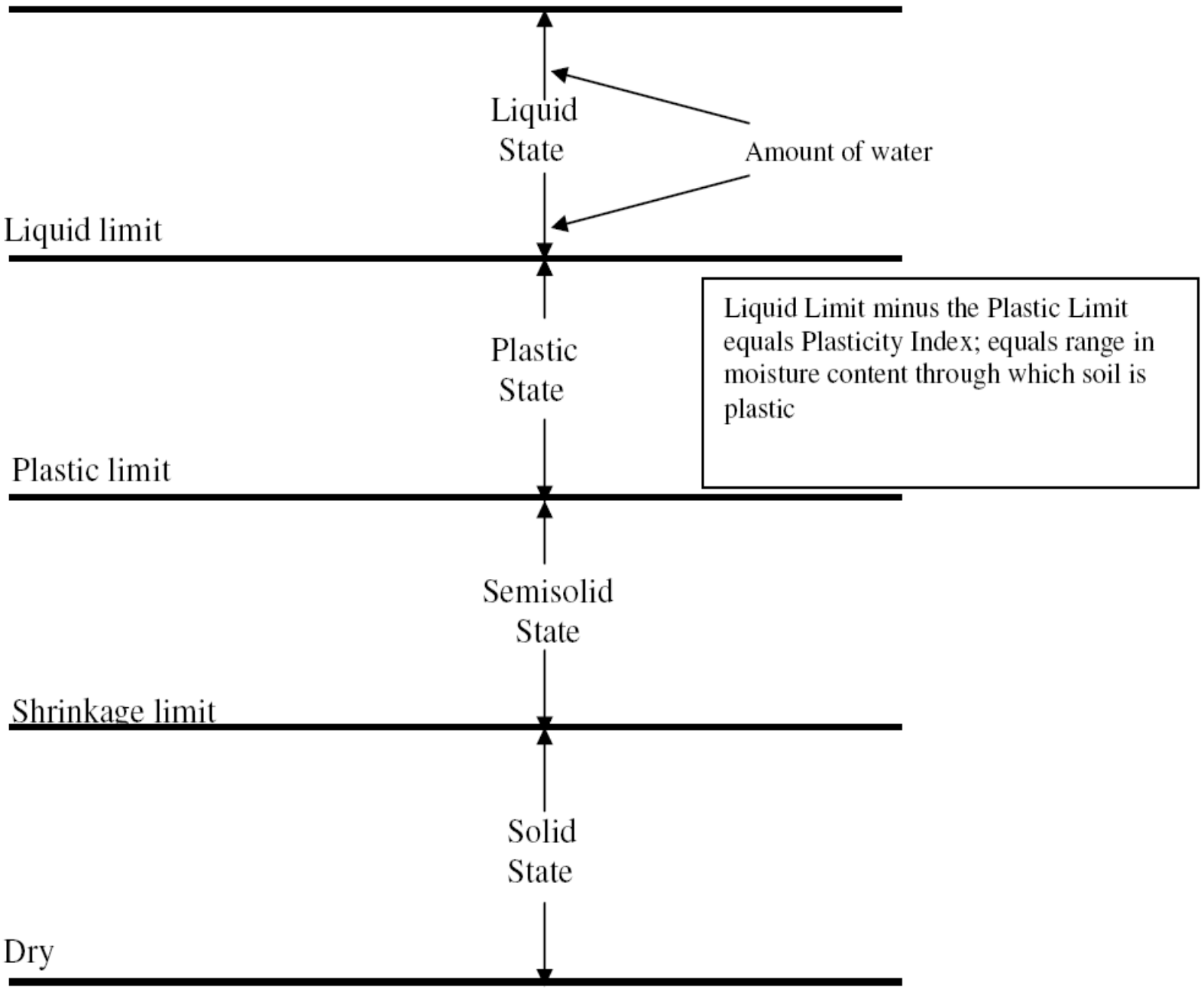

Liquid
State
Amount of water
Liquid limit
Plastic
State
Liquid Limit minus the Plastic Limit equals Plasticity Index; equals range in moisture content through which soil is plastic
Plastic limit
Semisolid
State
Shrinkage limit
Solid
State
Dry

Figure 1

AASHTO CLASSIFICATION

- The results from each AASHTO test are used to determine the soil classification.

- Table 3 (Pg.5) lists the main AASHTO groups, a general rating for use in subgrade, and a general description.

AASHTO CLASSIFICATON	General Subgrade Rating	GENERAL DESCRIPTION
A-1	Excellent	Well graded coarse to fine; non-plastic or feebly plastic; includes coarse without binder
A-1-a	Excellent	Mostly stone fragments or gravel
A-1-b	Excellent	Mostly coarse sand; may need added fines for a firm base; suitable or can be made suitable for granular base coarse
A-2-4 A-2-5	Excellent	Granular with binder characteristics of A-4 and A-5 soils
A-2-6 A-2-7	Excellent to Good	Granular with binder characteristics of A-6 and A-7 soils
A-2	Good	Soils are inferior to A-1 soils due to poor grading, inferior binder, or both generally are suitable as a blanket for very plastic subgrades slated to receive concrete pavement
A-3	Good	Sands deficient in soil binder and coarse material; equigranular; examples are fine beach or desert blown sands. Water has little affect on A-3 soils
A-4	Fair	Composed mostly of silt with only moderate to small amounts of coarse material and only small amounts of clay; can vary texturally from sandy loams to silt to clay loams
A-5	Fair	Similar to A-4 except that they include very poorly graded soils containing such things as mica; is a poor stability soil.
A-6	Fair to Poor	Composed predominately of clay with moderate to negligible amounts of coarse material; have low stability at high moisture contents but are pretty stable otherwise; show shrinkage cracks during dry weather; is a good soil other than the fact that it has great affinity for water
A-7	Poor	Composed predominately of clay like A-6 but due to the presence of one-size silt particles, organic matter, mica flakes, or lime carbonate, is elastic
A-7-5	Poor	Moderate plasticity indexes; may be highly elastic. P.I. less than or equal to L.L. –30
A-7-6	Poor	High plasticity indexes P.I. greater than L.L. –30

Table 3

SECTION 4
SOIL TERMINOLOGY AND IDENTIFICATION PROPERTIES

- When sampling a borrow pit, a boring log must be completed with a description of the material encountered.

- To aid in completing a general description for a boring log, refer to the general terms and definitions provided in Table 4 (Pg. 6).

Terms	Definition
Boulder	A rock fragment, usually rounded by weathering or abrasion, with average dimension of 12 inches or more
Cobble	A rock fragment, usually rounded by weathering or abrasion, with average dimension between 3 to 12 inches
Gravel	Rounded, sub-rounded, or angular particles of rock that will pass a 3-inch square opening sieve and be retained on a Number 4 Sieve.
Sand	Particles that will pass the Number 4 Sieve and be retained on the Number 200 Sieve
Silt	Material passing the Number 200 Sieve that is non-plastic and exhibits little or no strength when dried
Clay	Material passing the Number 200 Sieve that can be made to exhibit plasticity within a wide range of water contents and exhibits considerable dry strength
Fines	The portion of a soil sample passing a Number 200 Sieve
Marl	Unconsolidated white or dark gray calcium carbonate deposit
Muck	Finely divided organic material containing various amounts of mineral soil
Peat	Organic material in various stages of decomposition
Organic Clay	Clay containing microscopic size organic matter
Organic Silt	Silt containing microscopic size organic matter
Coarse-Grained Soil	Soil having a predominance of gravel and/or sand
Fine-Grained Soil	Soil having a predominance of silt and/or clay
Mixed-Grained Soil	Soil having significant proportions of both fine and coarse grained soil particles

Table 4

Table 5 provides methods for identifying items encountered while performing the field investigation.

Item	Method of Identification
Boulder	Identify by particle size
Cobble	Identify by particle size
Gravel	Identify by particle size.
Sand	Identify by particle size. Gritty grains that can easily be seen and felt. No plasticity or cohesion. Size ranges between gravel and silt.
Silt	Identify by behavior. Fines that have no plasticity. May be rolled into a thread but will easily crumble. Has no cohesion. When dry, can be easily broken by hand into powdery form.
Clay	Material passing the Number 200 Sieve that can be made to exhibit plasticity within a wide range of water contents and exhibits considerable dry strength.
Marl	A white or gray calcium carbonate paste. May contain granular spheres, shells, organic material or inorganic soils.
Muck	Black or dark brown finely divided organic material mixed with various proportions of sand, silt, and clay. May contain minor amounts of fibrous materials such as roots, leaves, and sedges.
Peat	Black or dark brown plant remains. The visible plant remains range form coarse fibers to finely divided organic material.
Organic Clay	Dark gray clay with microscopic size organic material dispersed throughout. May contain shell and/or fibers. Has weak structure which exhibits little resistance to kneading.
Organic Silt	Silt containing microscopic size organic matter.
Fill	Man-made deposits of natural soils and/or waste materials. If encountered, document components carefully.

Table 5

The following steps can be followed in identifying a soil encountered during the field investigation:

- Step 1 - Decide if soil sample is coarse-grained, fine-grained, mix-grained or organic. If mix-grained, decide whether coarse-grained or fine-grained predominates and record conclusion
- Step 2 – Determine principal or primary component. Use noun in soil description (i.e. Sand).

- Step 3 – Determine secondary component. Use adjective in soil description (i.e. Silty Sand).

- Step 4 – Determine if additional components exist. Use as additional adjectives (i.e. Silty Sand, Gravelly) and record conclusion

Some typical examples of soil component descriptions include: **Silty Fine Sand, Gravelly Sand, Clayey Gravel, Clayey Silt, Silty Clay, etc.**

- Table 6 (Pg. 8) lists additional information which should be documented on the boring log.

Item	Descriptions
Color of sample	Brown, Gray, Red, Black, etc.
Moisture Condition	Dry, Moist, Wet Judge by appearance as the material is initially removed
Plasticity	Plastic, Low Plastic, Non-plastic. Sample must be in moist or wet condition for plasticity determination.

Table 6

BRAIN TEASER

WHAT AASHTO TESTS ARE NECESSARY FOR DETERMINING THE AASHTO CLASSIFICATION OF A SOIL?

AASHTO T-88 - OVERALL PARTICLE DISTRIBUTION

AASHTO T-89 - LIQUID LIMIT (L.L.)

AASHTO T-90 - PLASTIC LIMIT (P.L.) AND PLASTICITY INDEX (P.I.)

BRAIN TEASER

WHAT IS THE FORMULA FOR DETERMINING THE PLASTICITY INDEX (P. I.)?

P. I. = L. L. - P. L.

The data obtained from the field investigation and the Soils Laboratory test results will serve to establish a soil profile of the borrow pit.

The soil profile is the vertical cross-section composed of three major layers designated as A, B, and C-horizons.

Horizon A: basically topsoil containing organic matter except for possibly the bottom part of the layer

Horizon B: the subsoil

Horizon C: the mother soil

The usable soil can primarily be found in the "B" horizon.

Section 5

GENERAL SAMPLING PROCEDURES

When sampling a borrow pit, the Contractor or NCDOT may obtain the soil samples.

(Pg.8)

1. Prior to performing any sampling, the Contractor shall furnish the Resident Engineer with a dimensioned plot plan of the proposed site to a scale such that it can be placed on 8 ½" X 11" or 11" X 17" sheet. The Contractor shall also provide a release from the property owner allowing access to the property and the right to obtain samples from the property.

2. Samples shall be obtained by the use of hand auger or power flight auger. Other equipment such as a dragline or backhoe may be used if approved by the Engineer.

3. Samples shall be obtained by the Resident Engineer or his/her representative with a valid Borrow Pit Sampling Certification.

4. Each sample shall consist of 5 to 8 pounds of soil (fill sample bag one quarter full). Place a completed sample card (refer to Appendix C) in each bag.

5. A minimum of two (2) test borings per acre will be required. The minimum number shall be increased if determined necessary in order to obtain representative samples for the entire source.

6. Each test boring shall be identified by a stake driven adjacent to the test boring hole. The test boring number shall be shown on the stake.

7. Within each boring site samples will be acquired from any significantly different layer of soil. Combining materials from different layers into a composite sample will not be permitted.

8. Each test boring shall be designated numerically (S-1, S-2, S-3, etc.) in the order of drilling.

9. The first sample from a test boring shall be identified by the test boring number.

Any additional samples from a test boring shall be identified by the test boring number plus an alphabetical letter (S-1, S-1A, S-1B, etc). These additional samples shall be designated alphabetically in order from the surface down.

10. If the same soil type exists between multiple bore sites the sample can be referenced to the original soil sample.

For example, if bore location number 3 from 0 – 2 feet contains the same soil as encountered at bore location number 1 (0 - 2 feet) then an entry can be made on the boring log to reference S-1 (i.e. R S-1).

Therefore, no sample would be required from bore location number 3 from 0 – 2 feet in depth. Referencing soils should only be completed when the individual is confident that the material is the same (if in doubt take a sample). Refer to Appendix B for a boring log example (Pg. 14).

HOLE #	DEPTH	SAMP #	DESCRIPTION AND COMMENTS
#1	0-2'	S-1	Brn-Tan Fine Sand
"	2-5'	S-1A	Tan-Gray Sandy Silt Water@3.9'
"	5-10'	S-1B	Tan-Red Fine Sand
"	10-18'	S-1C	Gray Fine Sand
"	18-29'	S-1D	Tan Fine-Coarse Sand
#2	0-3'	R(S-1)	Brn-Tan Fine Sand
"	3-7'	S-2	Tan-Gray F & Cse Sand Water@3.3'
"	7-13'	S-2A	Tan F & Cse Sand
"	13-23'	S-2B	Red-Tan F & Cse Sand
"	23-29'	S-2C	Red-Tan-Yel Coarse Sand
#3	0-2'	S-3	Brn-Tan Fine Sand
"	2-6'	S-3A	Tan Coarse Sand Water@3.8'
"	6-8'	S-3B	Red-Gray Sandy Silt
"	8-18'	S-3C	Tan-Red F & Cse Sand
"	18-23'	R(S-2B)	Red-Tan F&Cse Sand
"	23-29'	S-3D	Red-Tan Coarse Sand
#4	0-1'	R(S-3)	Brn-Tan Fine Sand
"	1-3'	S-4	Lt. Brn. Fine Sandy Silt
"	3-10'	S-4A	Gray Fine Sand Water@3.1'
"	10-13'	S-4B	Gray Sandy Silty Clay
"	13-23'	S-4C	Gray Fine Sand
"	23-29'	S-4D	Red-Tan Coarse Sand
#5	0-1'	R(S-3)	Brn-Tan Fine Sand
"	1-3'	S-5	Gray Fine Sandy Silt
"	3-5'	R(S-3A)	Tan Coarse Sand Water@4.0'
"	5-8'	S-5A	Gray Fine Sandy Silt
"	8-10'	R(S-4A)	Gray Fine Sand
"	10-13'	R(S-4B)	Gray Sandy Silty Clay
"	13-23'	S-5B	Gray Fine Sand
"	23-29	S-5C	Gray-Tan F & Cse Sand

11. A boring log shall be kept of each test boring and will show the following:

    a. Test boring number

    b. Visual description of the material encountered

    c. Elevation or depth below surface of layer of material encountered

    d. Location of samples obtained

    e. Location of water table

    f. Total depth of boring

12. For each source, a site map shall be prepared showing the following:

    a. The location of the source in relation to natural landmarks, property lines and/or existing public roads in the area.

    b. A plan view of the property and all test borings with identifying numbers labeled

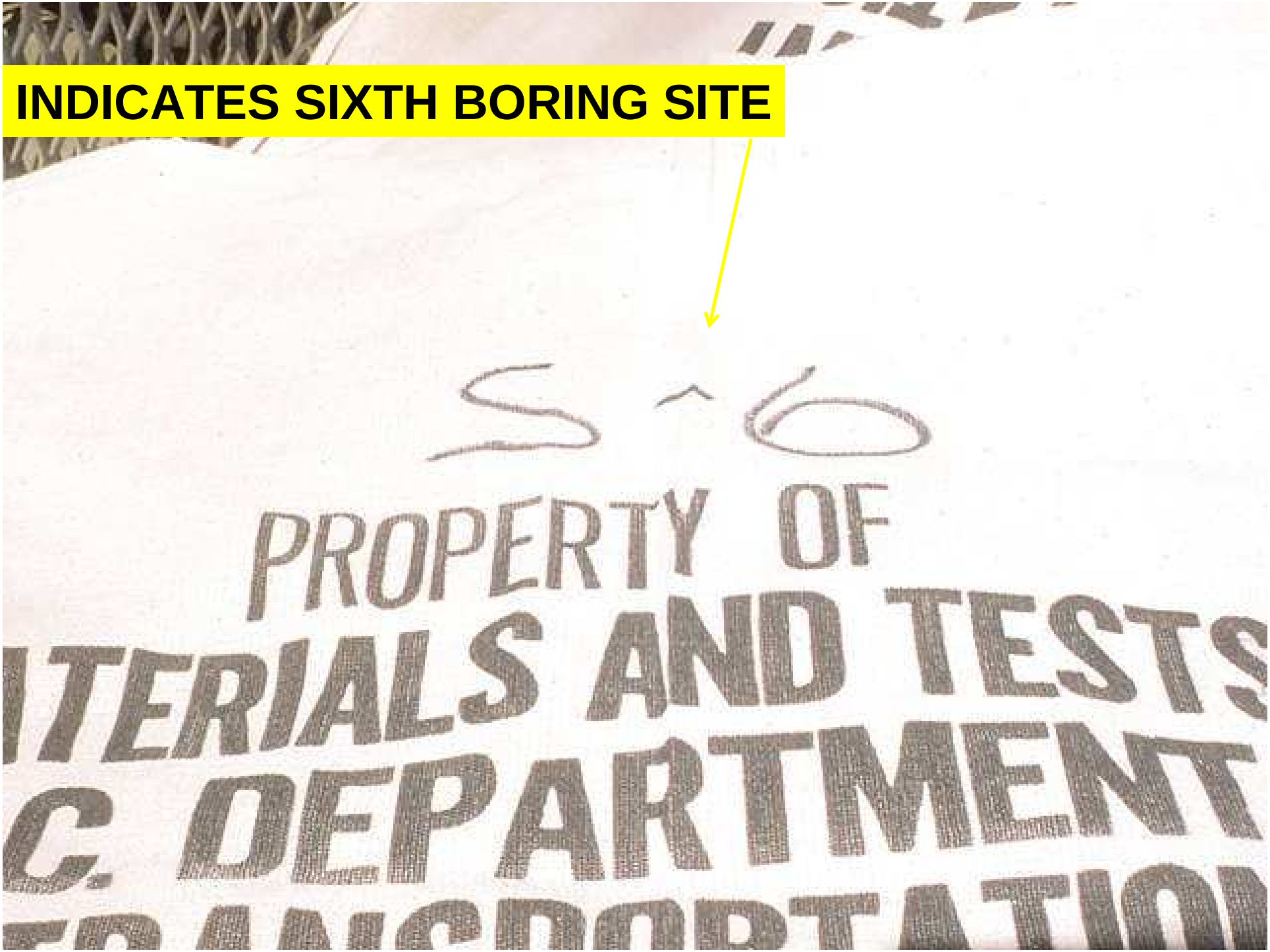

DRILL RIG


KNOW WHAT DEPTH SOIL CAME FROM...


CAREFULLY OBTAIN SAMPLE

CONTINUE DRILLING DOWN OBSERVING/RECORDING ANY CHANGES


EACH SAMPLE 5 TO 8 POUNDS OF SOIL


INDICATES SIXTH BORING SITE
S-6
PROPERTY OF
TERIALS AND TESTS
C. DEPARTMENT

BRAIN TEASER

HOW IS A TEST BORING SITE IDENTIFIED AND DESIGNATED IN THE BORROW PIT?

A STAKE IS DRIVEN NEXT TO THE BORE SITE AND IS DESIGNATED NUMERICALLY IN THE ORDER OF DRILLING

HOW MUCH SOIL IS OBTAINED FOR EACH SAMPLE?

5 TO 8 POUNDS
(ONE QUARTER OF A SAMPLE BAG FULL)

BRAIN TEASER

CAN DIFFERENT SOIL LAYERS FROM THE SAME BORING SITE BE COMBINED INTO ONE SAMPLE?

NO, EACH DISTINCTLY DIFFERENT LAYER MUST BE SAMPLED SEPERATELY

Section 6

SAMPLING PROCEDURES

If the Contractor performs sampling, the following procedures will apply in addition to the procedures listed in the previous section.

(Pg. 10)

1. The Contractor shall furnish all sampling equipment.

2. A Division of Highways representative shall determine the frequency and location of all test borings.

3. All samples will be taken in the presence of the Resident Engineer or his/her representative.

4. The Resident Engineer shall be responsible for ensuring that sufficient test borings are made and samples taken are representative of the proposed source.

5. The Contractor will be responsible for marking and placing an identifying stake at each boring site.

6. The Division of Highways representative shall transport all samples to a Materials and Test Unit laboratory. The Contractor shall not deliver any samples for testing. The Division of Highways will be responsible for any soil treatment necessary because of quarantine regulations of the U.S. and/or N.C. Department of Agriculture.

7. The Division of Highways representative shall maintain the boring log and prepare the site map. Upon completion of the investigation, one (1) copy of each will be transmitted to the Materials and Tests Unit.

BRAIN TEASER

WHEN THE CONTRACTOR TAKES THE SAMPLES, WHO CAN BRING THE SAMPLES TO M & T UNIT?

DIVISION OF HIGHWAYS REPRESENTATIVE

WHEN THE CONTRACTOR TAKES THE SAMPLES, WHO CAN DETERMINE THE FREQUENCY AND LOCATION OF THE TEST BORINGS?

DIVISION OF HIGHWAYS REPRESENTATIVE

Section 7
SAMPLING PROCEDURES

If the Department performs sampling, the following procedures will apply in addition to the procedures listed in the general sampling section.

(Pg.10)

1. The Contractor’s request for Department to perform the sampling shall be submitted to the Resident Engineer in writing.

2. The Resident Engineer will forward the request and the other required data to the Geotechnical Engineering Unit.

3. The Geotechnical Engineering Unit, prior to performing any sampling, will contact the Resident Engineer to determine if he/she desires that project personnel be present.

4. The Geotechnical Engineering Unit will obtain the samples and transport them to a Materials and Tests Unit laboratory for testing.

5. The Geotechnical Engineering Unit will be responsible for marking and placing an identifying stake at each boring site.

6. The Geotechnical Engineering Unit will be responsible for any soil treatment necessary due to quarantine regulations of the U. S. and/or N. C. Department of Agriculture.

7. The Geotechnical Engineering Unit will be responsible for submitting cost data to the Finance Department for invoicing the Contractor.

BRAIN TEASER

WHEN THE DEPARTMENT TAKES THE SAMPLES, WHO CAN BRING THE SAMPLES TO M & T UNIT?

GEOTECHNICAL ENGINEERING REPRESENTATIVE

Section 8

APPROVING BORROW SOURCE

Pg.11

The Material and Tests Unit will submit copies of all test reports to the Resident Engineer for analysis. The Resident Engineer, utilizing the latest revision of the “Criteria for Acceptance of Borrow Material” (refer to appendix A), will analyze the test results, boring logs, and site map to determine the acceptability of the source. The Resident Engineer will also consider any applicable project special provisions as the basis for making the determination.

The Geotechnical Engineering Unit, if requested, will assist the Resident Engineer in evaluating the material.

The Resident Engineer will advise the Contractor in writing the following issues:

1. The limits of acceptable material.
2. If special handling of the material is necessary.
3. Approval of the source for borrow material is based on the limited sampling and test results of the samples submitted. Therefore, such approval is with the understanding that the Division of Highways reserves the right to use visual inspection and additional sampling on the roadway, as deemed appropriate by the Engineer, to reject any unsuitable material encountered. The rejection may occur regardless of whether or not such material was indicated as acceptable during initial borrow pit sampling.

4. Where deemed appropriate, the Resident Engineer will designate how the material is to be removed from the pit and also where to isolate areas or layers of unsuitable material in the pit.

5. Any material found on the roadway that fails to meet the acceptability requirements, shall be removed and replaced with acceptable material at no cost to the Department.

BRAIN TEASER

IF UNSUITABLE MATERIAL IS ENCOUNTERED IN AN APPROVED BORROW PIT AND IS BEING HAULED TO THE PROJECT, CAN THE ENGINEER REJECT THE MATERIAL?

YES, REJECTION MAY OCCUR REGARDLESS OF WHETHER OR NOT SUCH MATERIAL WAS INDICATED AS ACCEPTABLE DURING INITIAL BORROW PIT SAMPLING

Criteria for Acceptance of Borrow Material

I. Statewide Criteria: (See exceptions in II)

Only natural earth materials may be used as borrow material. Any other materials are subject to rejection (see II-b).

Soil with P. I. of 25 or less……..Acceptable

Soil with P. I. of 26 thru 35…….Acceptable, but not to be used in 2 ft of embankment or backfill.

Soil with P. I. of more than 35……Not acceptable

II. Exceptions to Statewide Criteria:

A) Soils in the Coastal Plain (area described below) shall be accepted in accordance with the following:

Soils with P. I. of 15 or less……Acceptable

Soils with P. I. of 16 thru 20……Acceptable, but not to be used in top 2 ft. of embankment or backfill.

Soils with P. I. of more than 20……Not acceptable

Areas Applicable:

Division 1….Entire Division except Northampton (West of I-95)

Division 2….Entire Division

Division 3….Entire Division

Division 4….Edgecombe, Wayne, Johnston, (East of US-301), Wilson (East of I-95), Nash (East of I-95), Halifax (East of I-95)

Division 6….Bladen, Columbus, Robeson, Cumberland, Harnett (South of NC-27)

Division 8….Scotland, Hoke, Moore (Southeast of US 15-501, NC-73, NC-211), Richmond (East of US-220) North and US-1 South)

Also applicable to the floodplains of the Roanoke, Tar, Neuse, Cape Fear, and Lumber Rivers and their tributaries which are outside the above described areas.

b) Waste or by-products from industrial processes or mining operations are not acceptable except by specific, written approval of the Engineer. This includes soil overburden from quarries.

c) When tested, soils having a pH less than 5.5 or an organic content more than 4.0 % may be rejected.

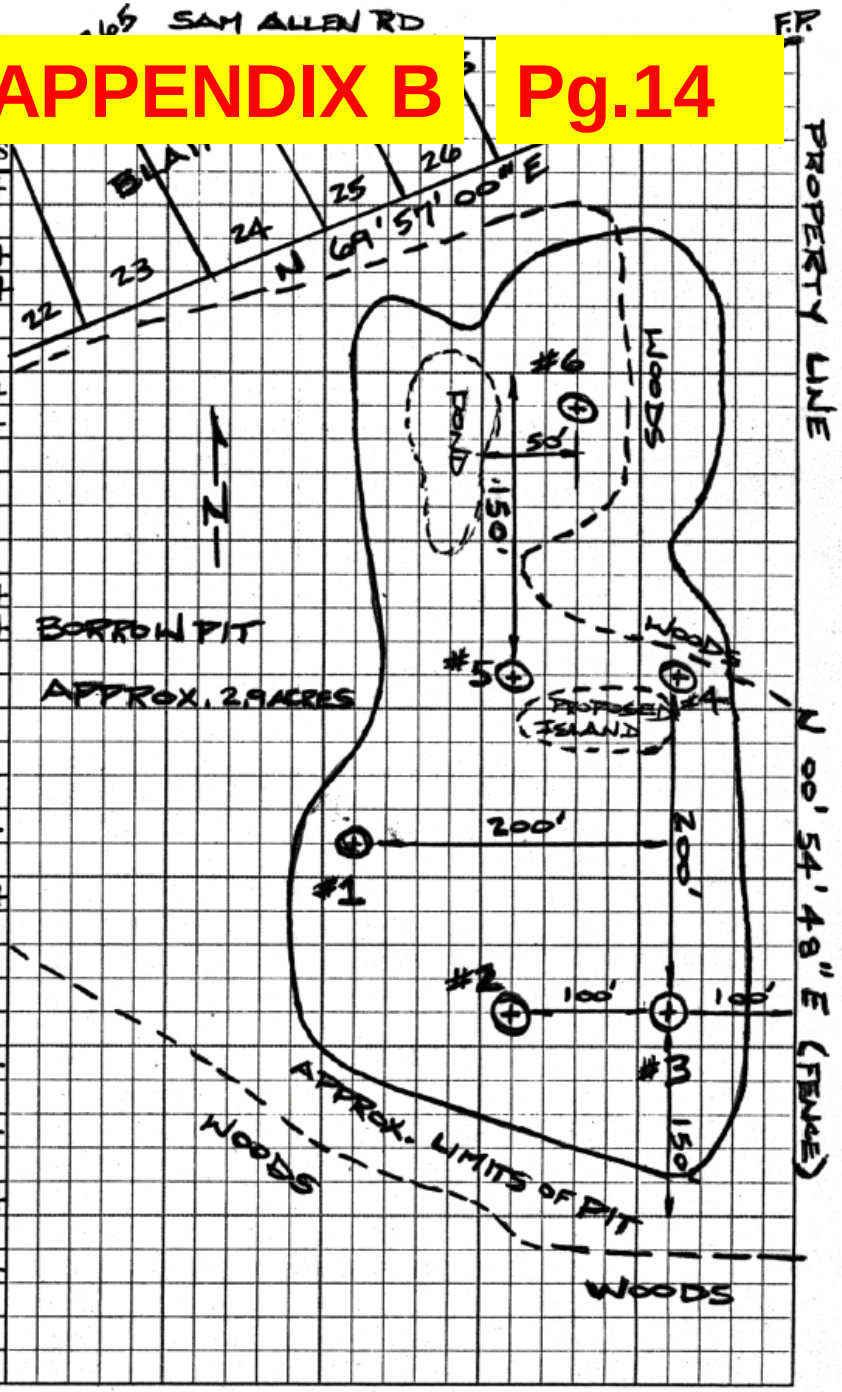
APPENDIX B **Pg.14**

PROJECT: 6.142008T TIP: N/A DATE: 10/8

COUNTY: WASHINGTON

NOTES BY: R.M. ROGERS DRILLED BY: NRB & CMW PAGE # 1 of

HOLE #	DEPTH	SAMP #	DESCRIPTION AND COMMENTS	MOIST	CLASS
#1	0-2'	S-1	Brn-Tan Fine Sand	Moist	A-2-4
"	2-5'	S-1A	Tan-Gray Sandy Silt Water@3.9'	Wet	A-4
"	5-10'	S-1B	Tan-Red Fine Sand	Sat.	A-2-4
"	10-18'	S-1C	Gray Fine Sand	Sat.	A-2-4
"	18-29'	S-1D	Tan Fine-Coarse Sand	Sat.	A-3
#2	0-3'	R(S-1)	Brn-Tan Fine Sand	M-Wet	A-2-4
"	3-7'	S-2	Tan-Gray F & Cse Sand Water@3.3'	Sat.	A-2-4
"	7-13'	S-2A	Tan F & Cse Sand	Sat.	A-3
"	13-23'	S-2B	Red-Tan F & Cse Sand	Sat.	A-3
"	23-29'	S-2C	Red-Tan-Yel Coarse Sand	Sat.	A-3
#3	0-2'	S-3	Brn-Tan Fine Sand	M-Wet	A-2-4
"	2-6'	S-3A	Tan Coarse Sand Water@3.8'	W-Sat	A-2-4
"	6-8'	S-3B	Red-Gray Sandy Silt	Sat.	A-4
"	8-18'	S-3C	Tan-Red F & Cse Sand	Sat.	A-3
"	18-23'	R(S-2B)	Red-Tan F & Cse Sand	Sat.	A-3
"	23-29'	S-3D	Red-Tan Coarse Sand	Sat.	A-3
#4	0-1'	R(S-3)	Brn-Tan Fine Sand	Moist	A-2-4
"	1-3'	S-4	Lt. Brn. Fine Sandy Silt	Wet	A-4
"	3-10'	S-4A	Gray Fine Sand Water@3.1'	Sat.	A-2-4
"	10-13'	S-4B	Gray Sandy Silty Clay	Sat.	A-6
"	13-23'	S-4C	Gray Fine Sand	Sat.	A-3
"	23-29'	S-4D	Red-Tan Coarse Sand	Sat.	A-3
#5	0-1'	R(S-3)	Brn-Tan Fine Sand	Moist	A-2-4
"	1-3'	S-5	Gray Fine Sandy Silt	Wet	A-4
"	3-5'	R(S-3A)	Tan Coarse Sand Water@4.0'	Sat.	A-2-4
"	5-8'	S-5A	Gray Fine Sandy Silt	Sat.	A-4
"	8-10'	R(S-4A)	Gray Fine Sand	Sat.	A-2-4
"	10-13'	R(S-4B)	Gray Sandy Silty Clay	Sat.	A-6
"	13-23'	S-5B	Gray Fine Sand	Sat.	A-2-4
"	23-29	S-5C	Gray-Tan F & Cse Sand	Sat.	A-3



APPENDIX C

Pg.18

/ Based on Material

HiCAMS #:

*Material: PROPOSED BORROW (SOIL)

☐ Metric
☒ English

†Sample Owner: PATRICK

†Contract #: N/A

*Testing Category: QUALITY

Field ID: S-1

Check Sample? Y N (circle one)

Proj/PO/WO #: 6.142008T

†Related Sample ID: N/A

Line Item #: N/A

†Corr. Sample ID: N/A

RE: N.W. WAINAINA

Of Pieces: 1

*Rep. Qty: 0 to 2 ft. depth

*To Be Used In: ASPHALT PLANT

Comment: Proposed borrow pit for state asphalt plant off of SR 1365

*Sampled Date: 10/08/02

*Sampled By: R.M. ROGERS

*Sample From: PROPOSED PIT

Truck/ Container #: N/A

Structure Number: N/A

Route Desc:

Route Type: I US NC SR (circle one)

Alignment:

Route Number: 0

*Location: HOLE # 1

Offset Dist.:

Map Number: N/A

*Sta. From: +

Sta. To: +

County: WASHINGTON

Coastal Plain: (Y) N (circle one)

†Producer / Supplier:

† Plant ID #:

☐ Approved
☐ Other

†Brand Name:

Shelf Life Date:

†Date Produced:

†Concrete Mix:

†Asphalt Mix / JMF ID:

† Alternate IDs Type: | Prefix: | Range: | Description of Items:

Please use reverse side for test data, comments, and additional information... Check here if more on reverse ☐

Pg.19

* *Required Field*
† *May Be Required Based on Material*

HiCAMS #:

☐ Metric
☒ English

*Material: PROPOSED BORROW PIT (SOIL)

†Sample Owner: PATRICK
†Contract #: N/A

*Testing Category: QUALITY
Field ID: S-1A

Check Sample? Y N (circle one)
Proj/PO/WO #: 6.1420088T

†Related Sample ID: N/A
Line Item #: N/A

†Corr. Sample ID: N/A
RE: N. W. WAINAINA

Of Pieces: 1
*Rep. Qty: 2 to 5 ft. depth

*To Be Used In: ASPHALT PLANT

Comment: Proposed borrow pit for state asphalt plant off of SR 1365

*Sampled Date: 10/08/02
*Sampled By: R. M. ROGERS

*Sample From: PROPOSED PIT
Truck/ Container #: N/A

Structure Number: N/A
Route Desc:

Route Type: I US NC SR (circle one)
Alignment:

Route Number: 0
*Location: HOLE # 1
Offset Dist.:

Map Number: N/A
*Sta. From: +
Sta. To: +

County: WASHINGTON
Coastal Plain: (Y) N (circle one)

☐ Approved
☐ Other

†Producer / Supplier:
† Plant ID #:

†Brand Name:
Shelf Life Date:

†Date Produced:

†Concrete Mix:
†Asphalt Mix / JMF ID:

† Alternate IDs

Type:	Prefix:	Range:	Description of Items:

Please use reverse side for test data, comments, and additional information... Check here if more on reverse ☐

* *Required Field*
† *May Be Required Based on Material*

HiCAMS #:

* Material: SOIL — ☒ Metric ☐ English

† Sample Owner: PROJECT — † Contract #: C201977

* Testing Category: ACCEPTANCE — Field ID: S-1

Check Sample? Y (N) (circle One) — Proj/Po/Wo#: 35196.3.ST1

† Related Sample ID: — Line Item #: 12

† Corr. Sample ID: — RE: I.M. RESIDENT

# of Pieces: 1 BAG — * Rep. Qty: 3800

* To Be Used In: EMBANKMENT AND/OR SUBGRADE

Comment: BORROW PIT #1 - HOLE #1
SAMPLE REPRESENTS 0-.5 m DEPTH

* Sampled Date: 8-3-09 — * Sampled By: I.R. AUGAR — CERT# 12345

* Sample From: BORROW PIT — Truck/ Container #:

Structure Number: — Route Desc: FAYETTEVILLE LOOP

Route Type: (I) US NC SR (circle one) — Alignment:

Route Number: 495 — *Location: HOLE#1 — Offset Dist.:

Map Number: — *Sta. From: 1+00 — Sta. To: 1+00

County: CUMBERLAND — Coastal Plain: (Y) N (circle one)

† Producer/Supplier: — † Plant ID#: — ☐ Approved ☐ Other

† Brand Name: — Shelf Life Date:

† Date Produced:

† Concrete Mix: — †Asphalt Mix/ JMF ID:

† Alternate IDs Type:	Prefix	Range:	Description of Items:

Please use reverse side for test data, comments, and additional information. Check here if more on reverse ☐

APPENDIX D

Pg.21

M & T Form 503

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
SOILS LABORATORY

T. I. P. No. _____

REPORT ON SAMPLES OF BORROW --- Costal Plan Criteria

Project	6.142008T	**County**	WASHINGTON	**Owner**	PATRICK
Date: Sampled	10/8/02	**Received**	10/10/02	**Reported**	10/14/02
Sampled from	PROPOSED PIT			**By**	R. M. ROGERS
Submitted by	N. W. WAINAINA				1995 **Standard Specifications**

699976 TO 700003
10/14/02

TEST RESULTS

Proj. Sample No.		S-1	S-1A	S-1B	S-1C	S-1D	S-2
Lab. Sample No.		699976	699977	699978	699979	699980	699981
Retained #4 Sieve	%	-	-	-	-	-	-
Passing #10 Sieve	%	100	100	100	100	100	100
Passing #40 Sieve	%	96	97	100	98	82	96
Passing #200 Sieve	%	24	40	13	16	5	11

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	22.8	10.8	10.8	14.0	50.3	36.4
Fine Sand Ret - #270	%	56.3	55.1	78.0	72.3	46.1	55.1
Silt 0.05 - 0.005 mm	%	12.8	16.0	7.2	7.6	1.6	1.5
Clay < 0.005 mm	%	8.0	18.0	4.0	6.0	2.0	7.0
Passing #40 Sieve	%	-	-	-	-	-	-
Passing #200 Sieve	%	-	-	-	-	-	-

L. L.		14	25	22	19	18	21
P. I.		NP	6	NP	NP	NP	NP
AASHTO Classification		A-2-4(0)	A-4(0)	A-2-4(0)	A-2-4(0)	A-3(0)	A-2-4(0)
Station							
Hole No.							
Depth (Ft)		0.00	2.00	5.00	10.00	18.00	3.00
	to	2.00	5.00	10.00	18.00	29.00	7.00
		OK	OK	OK	OK	OK	OK

cc: N. W. WAINAINA
L. T. PACKER
Soils File

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
SOILS LABORATORY

T. I. P. No. _____

REPORT ON SAMPLES OF BORROW --- Costal Plan Criteria

Project	6.142008T	**County**	WASHINGTON	**Owner**	PATRICK
Date: Sampled	10/8/02	**Received**	10/10/02	**Reported**	10/14/02
Sampled from	PROPOSED PIT			**By**	R. M. ROGERS
Submitted by	N. W. WAINAINA			1995	**Standard Specifications**

699976 TO 700003
10/14/02

TEST RESULTS

Proj. Sample No.		S-2A	S-2B	S-2C	S-3	S-3A	S-3B
Lab. Sample No.		699982	699983	699984	699985	699986	699987
Retained #4 Sieve	%	-	-	-	-	-	-
Passing #10 Sieve	%	100	100	100	100	100	100
Passing #40 Sieve	%	95	92	76	96	96	99
Passing #200 Sieve	%	5	5	3	22	13	44

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	40.4	40.2	62.8	25.5	27.1	6.6
Fine Sand Ret - #270	%	55.3	55.9	34.4	55.3	61.1	54.5
Silt 0.05 - 0.005 mm	%	2.3	1.9	1.8	13.2	3.8	20.8
Clay < 0.005 mm	%	2.0	2.0	1.0	6.0	8.0	18.0
Passing #40 Sieve	%	-	-	-	-	-	-
Passing #200 Sieve	%	-	-	-	-	-	-

L. L.		19	20	16	16	20	23
P. I.		NP	NP	NP	NP	NP	6
AASHTO Classification		A-3(0)	A-3(0)	A-3(0)	A-2-4(0)	A-2-4(0)	A-4(0)
Station							
Hole No.							
Depth (Ft)		7.00	13.00	23.00	0.00	2.00	6.00
	to	13.00	23.00	29.00	2.00	6.00	8.00
		OK	OK	OK	OK	OK	OK

APPENDIX E

PG.26

- The following pages contain additional soil report examples from a different project. Note the samples which have restrictions due to the P.I. (noted by *) exceeding specified criteria. During construction, project personnel must take precautions to ensure soils within these areas of the borrow pit are not placed in the top two feet of the embankment or backfill sections.

Submitted by R. O. BLACK JR. 1990 Standard Specifications

931061 TO 931074
10/17/02

TEST RESULTS

Proj. Sample No.		1	1A	1B	2	2A	3
Lab. Sample No.		931061	931062	931063	931064	931065	931066
Retained #4 Sieve	%	-	-	-	-	-	-
Passing #10 Sieve	%	100	100	100	100	100	100
Passing #40 Sieve	%	99	100	100	100	100	97
Passing #200 Sieve	%	77	83	87	85	94	82

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	18.0	14.0	12.0	21.0	16.0	19.0
Fine Sand Ret - #270	%	18.0	7.0	10.0	17.0	10.0	17.0
Silt 0.05 - 0.005 mm	%	43.0	40.0	32.0	27.0	29.0	40.0
Clay < 0.005 mm	%	21.0	39.0	46.0	35.0	45.0	24.0
Passing #40 Sieve	%	-	-	-	-	-	-
Passing #200 Sieve	%	-	-	-	-	-	-

L. L.		49	54	62	55	59	46
P. I.		10	21	28*	16	28*	14
AASHTO Classification		A-5(10)	A-7-5(20)	A-7-5(29)	A-7-5(18)	A-7-5(32)	A-7-5(13)
Station							
Hole No.		1	1	1	2	2	3
Depth (Ft)		0.00	3.00	8.00	0.00	4.00	0.00
	to	3.00	8.00	11.00	4.00	9.00	2.00
		OK	OK	--	OK	--	OK

cc: R. O. BLACK
Soils File

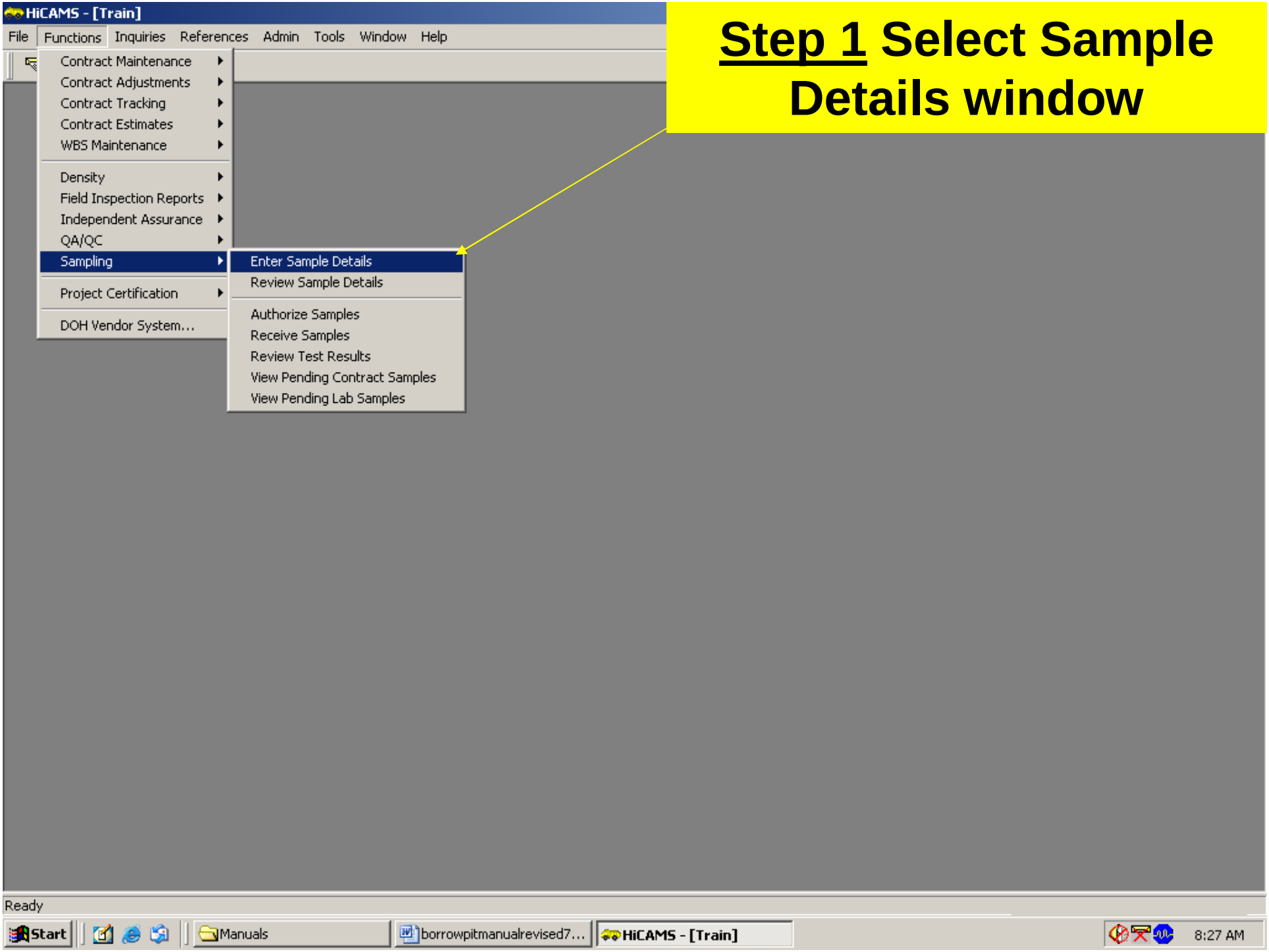
* Acceptable But Not to be used in the top 2 ft of embankment or backfill.

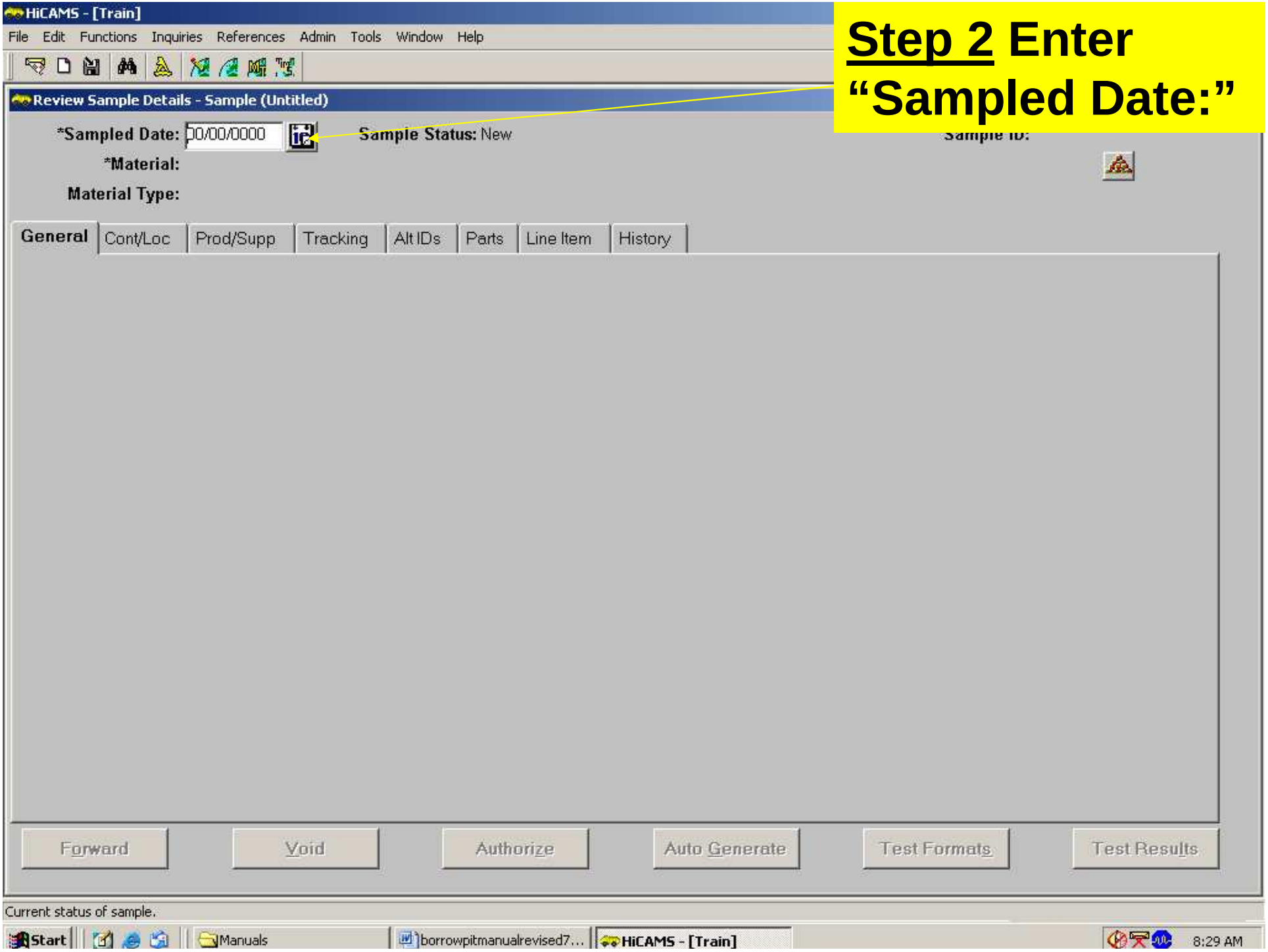
APPENDIX F
PG. 29

- This appendix summarizes the steps for entering borrow pit soil samples into HiCAMS.

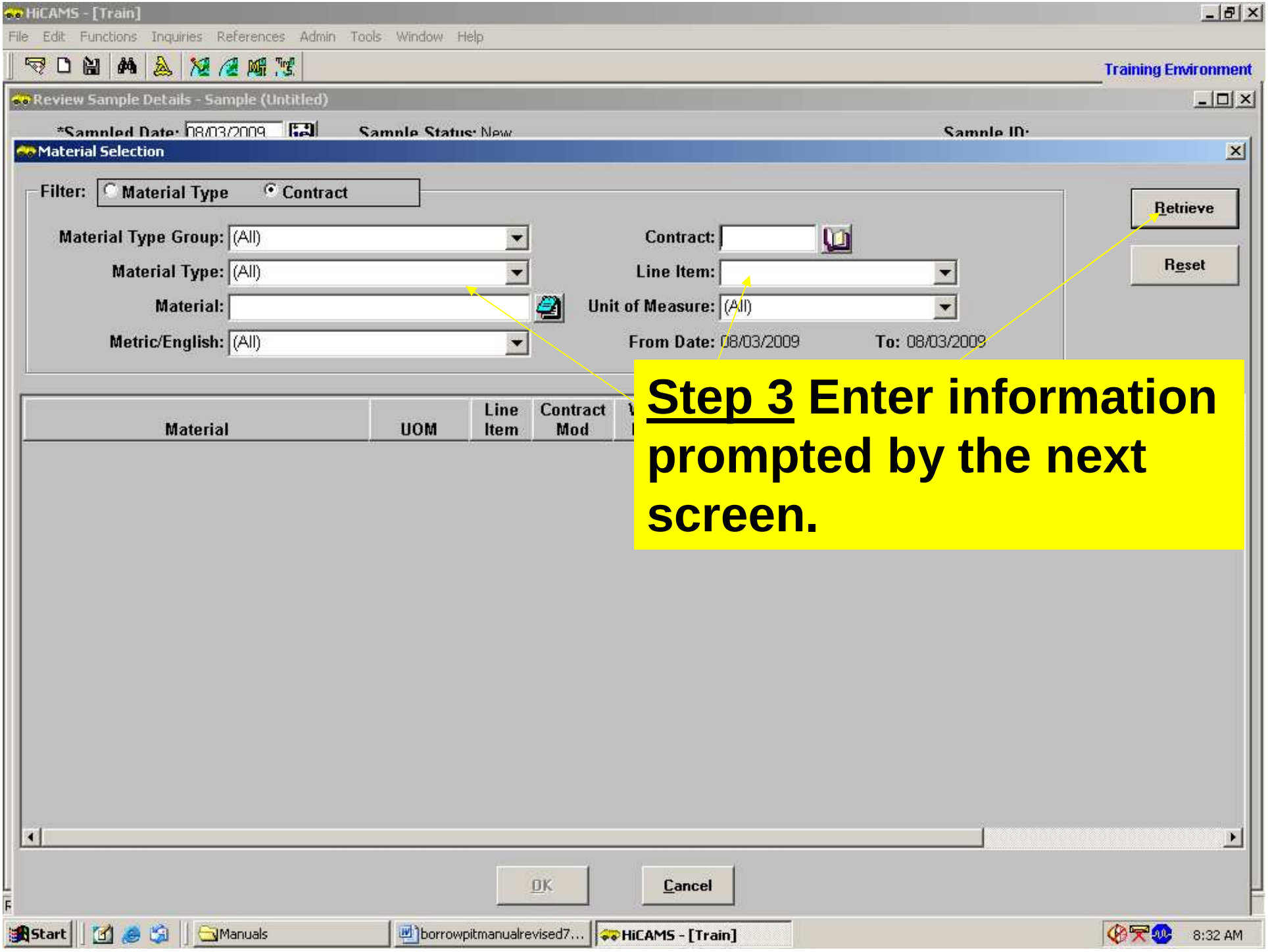
- If the Technician sampling a proposed borrow pit does not have an active Borrow Pit Sampling Certification the sample will not count towards the minimum sampling frequency as required by the Minimum Sampling Guide. Any samples obtained by a Technician without a valid certification will be used for information only.

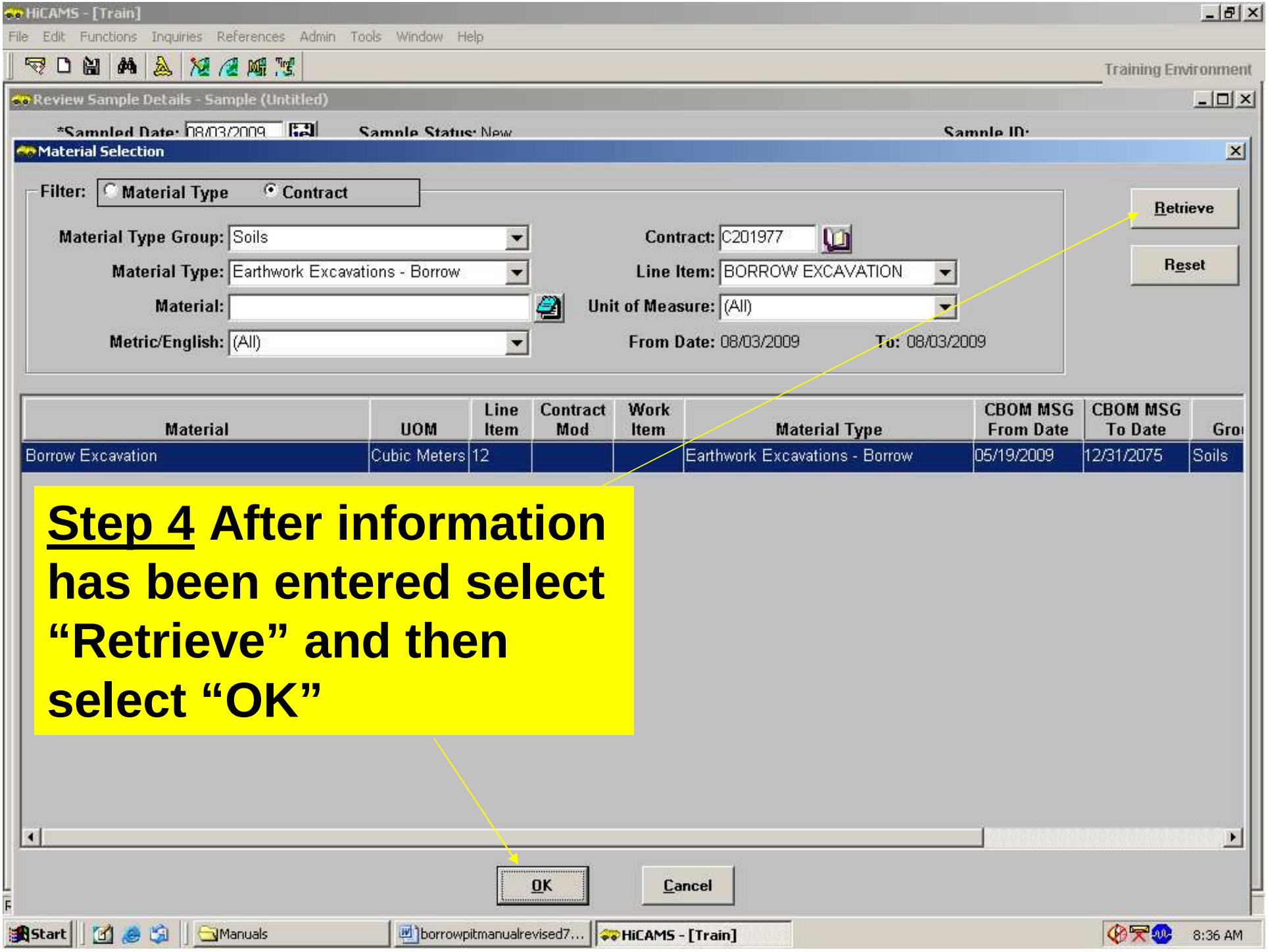
- ** For this example, the sample was obtained for a construction project in the Cumberland County area.

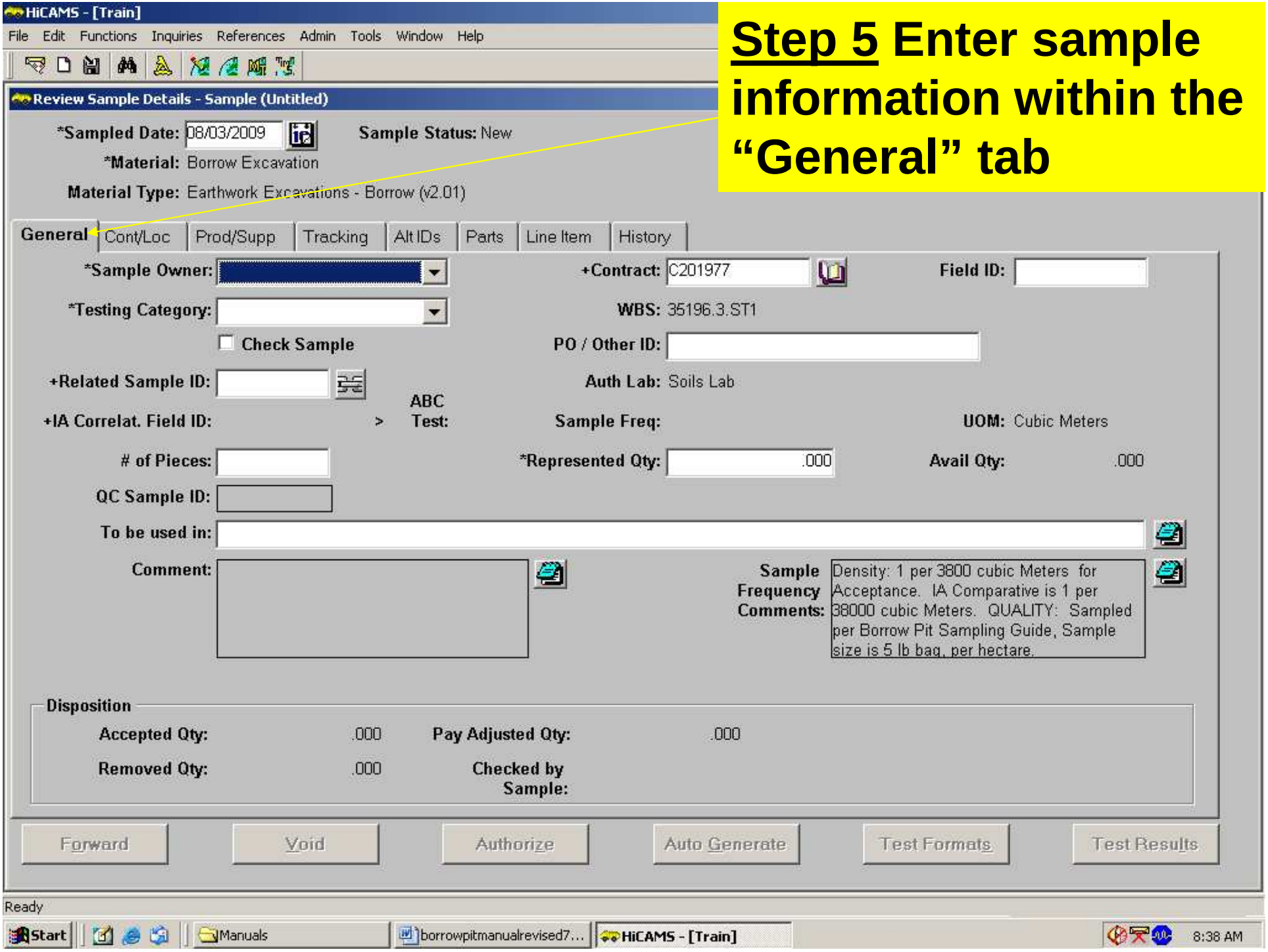

HiCAMS - [Train]
File
Functions
Inquiries
References
Admin
Tools
Window
Help
Contract Maintenance
Contract Adjustments
Contract Tracking
Contract Estimates
WBS Maintenance
Density
Field Inspection Reports
Independent Assurance
QA/QC
Sampling
Project Certification
DOH Vendor System...
Enter Sample Details
Review Sample Details
Authorize Samples
Receive Samples
Review Test Results
View Pending Contract Samples
View Pending Lab Samples
Step 1 Select Sample Details window
Ready
Start
Manuals
borrowpitmanualrevised7...
HiCAMS - [Train]
8:27 AM



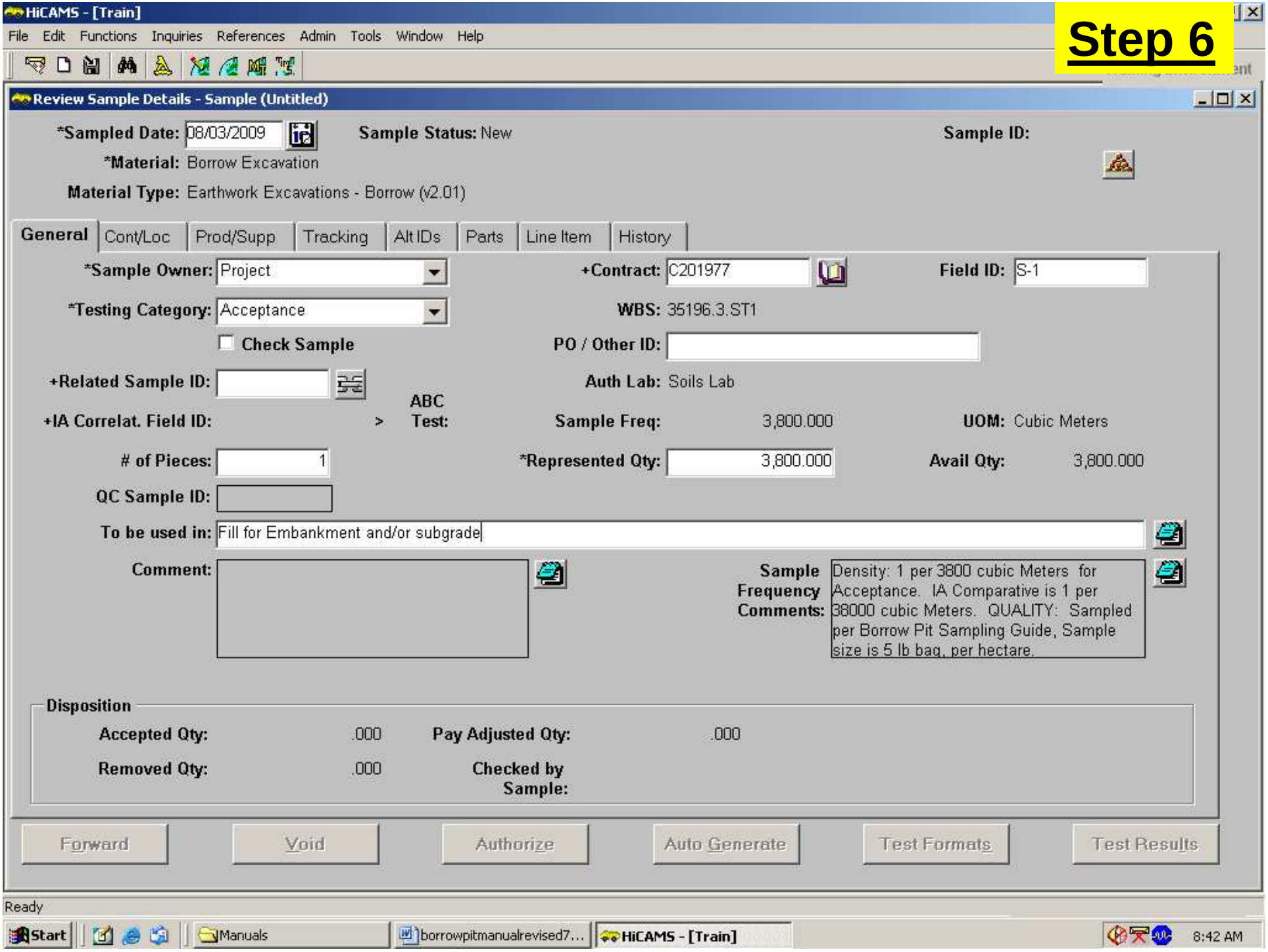
Step 2 Enter "Sampled Date:"

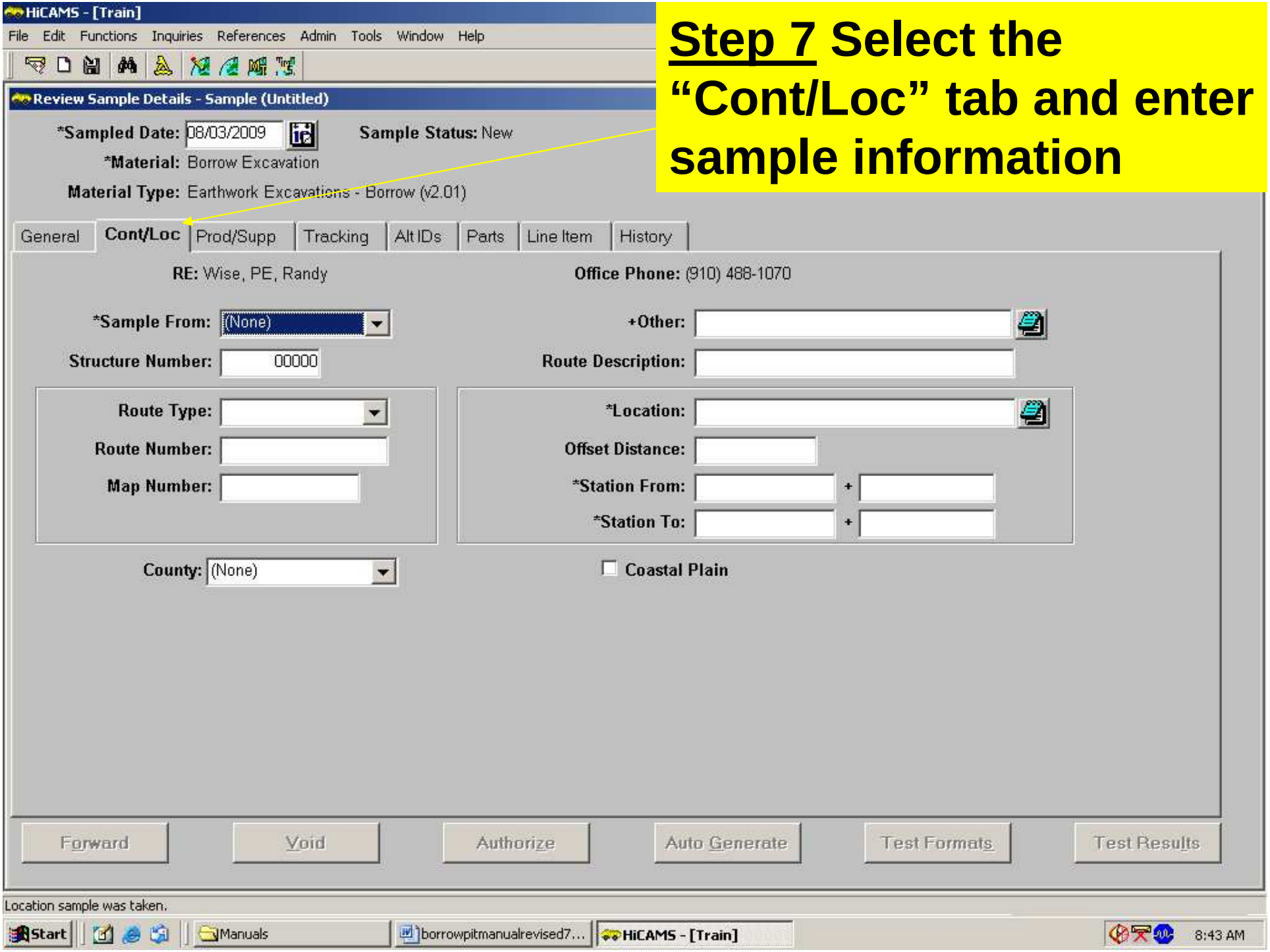

HiCAMS - [Train]
File Edit Functions Inquiries References Admin Tools Window Help
Training Environment
Review Sample Details - Sample (Untitled)
*Sampled Date: 08/03/2009
Sample Status: New
Sample ID:
Material Selection
Filter: Material Type Contract
Material Type Group: (All)
Material Type: (All)
Material:
Metric/English: (All)
Contract:
Line Item:
Unit of Measure: (All)
From Date: 08/03/2009
To: 08/03/2009
Retrieve
Reset
Material
UOM
Line Item
Contract Mod
Step 3 Enter information prompted by the next screen.
OK
Cancel
Start
Manuals
borrowpitmanualrevised7...
HiCAMS - [Train]
8:32 AM


HiCAMS - [Train]
File Edit Functions Inquiries References Admin Tools Window Help
Training Environment
Review Sample Details - Sample (Untitled)
*Sampled Date: 08/03/2009
Sample Status: New
Sample ID:
Material Selection
Filter: Material Type Contract
Material Type Group: Soils
Material Type: Earthwork Excavations - Borrow
Material:
Metric/English: (All)
Contract: C201977
Line Item: BORROW EXCAVATION
Unit of Measure: (All)
From Date: 08/03/2009
To: 08/03/2009
Retrieve
Reset
Material
UOM
Line Item
Contract Mod
Work Item
Material Type
CBOM MSG From Date
CBOM MSG To Date
Gro
Borrow Excavation
Cubic Meters
12
Earthwork Excavations - Borrow
05/19/2009
12/31/2075
Soils
Step 4 After information has been entered select "Retrieve" and then select "OK"
OK
Cancel
Start
Manuals
borrowpitmanualrevised7...
HiCAMS - [Train]
8:36 AM

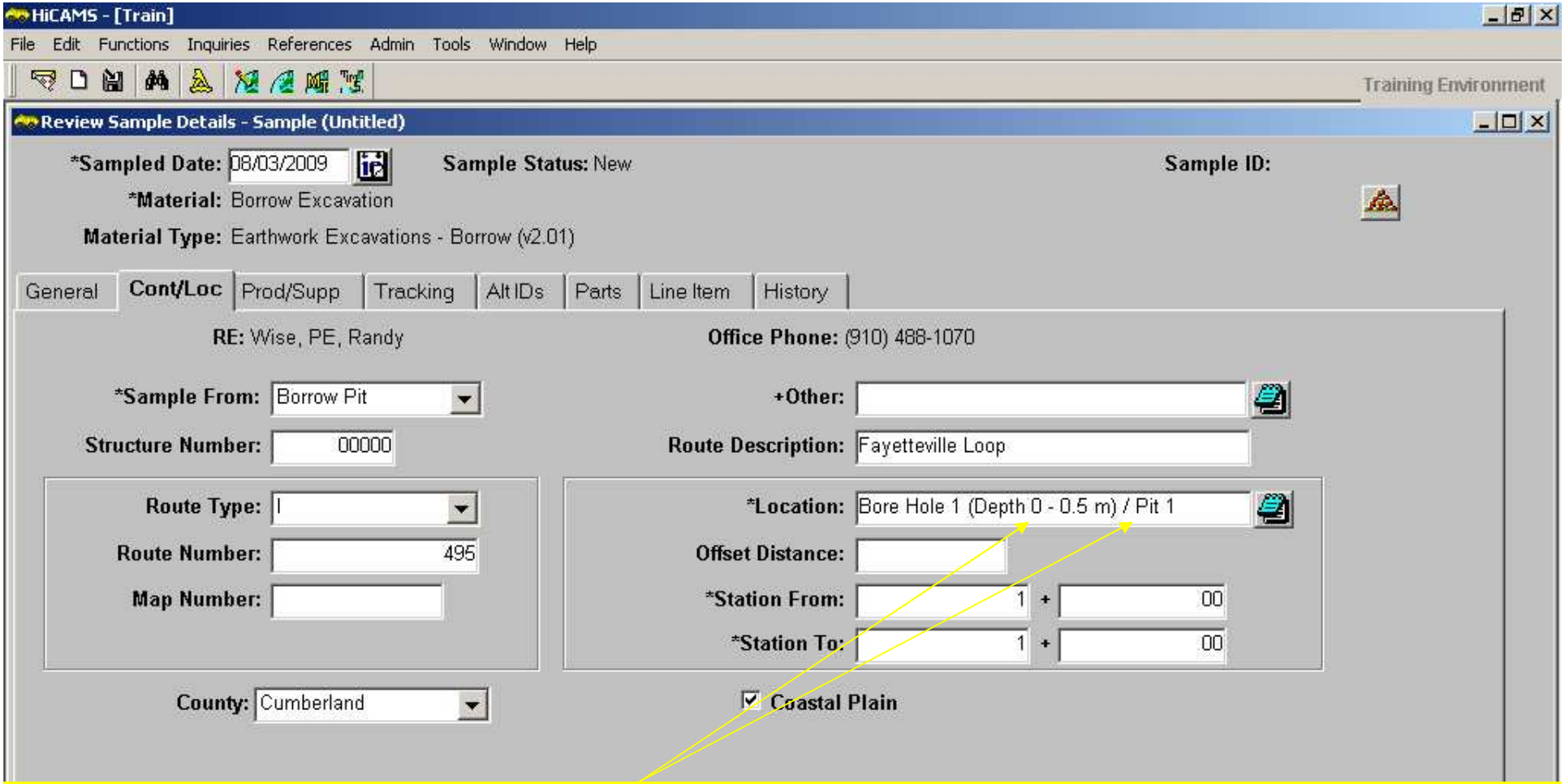


Step 5 Enter sample information within the "General" tab

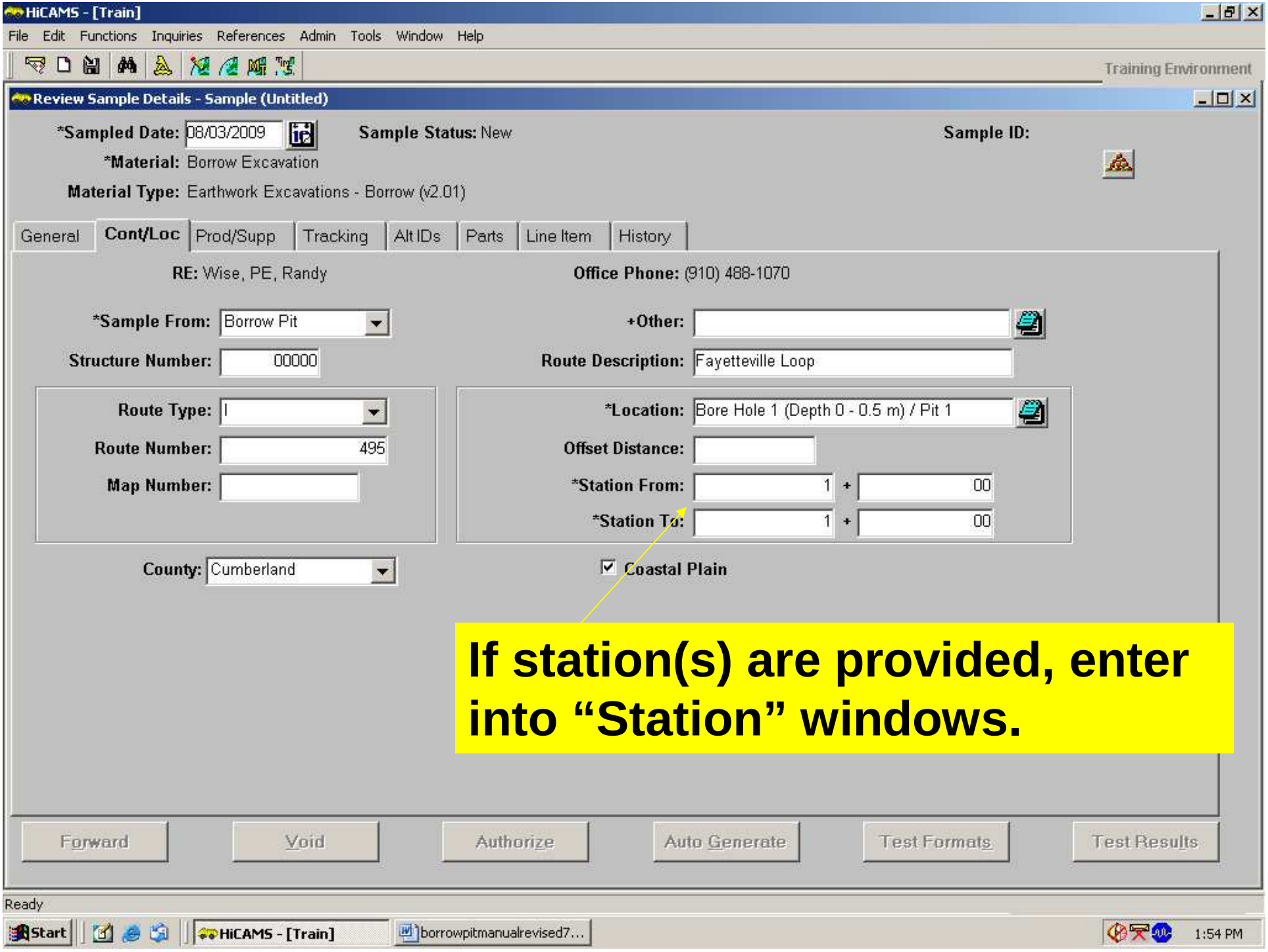

HiCAMS - [Train]
File Edit Functions Inquiries References Admin Tools Window Help
Step 6
Review Sample Details - Sample (Untitled)
*Sampled Date: 08/03/2009
Sample Status: New
Sample ID:
*Material: Borrow Excavation
Material Type: Earthwork Excavations - Borrow (v2.01)
General
Cont/Loc
Prod/Supp
Tracking
Alt IDs
Parts
Line Item
History
*Sample Owner: Project
+Contract: C201977
Field ID: S-1
*Testing Category: Acceptance
WBS: 35196.3.ST1
Check Sample
PO / Other ID:
+Related Sample ID:
Auth Lab: Soils Lab
+IA Correlat. Field ID:
ABC Test:
Sample Freq: 3,800.000
UOM: Cubic Meters
# of Pieces: 1
*Represented Qty: 3,800.000
Avail Qty: 3,800.000
QC Sample ID:
To be used in: Fill for Embankment and/or subgrade
Comment:
Sample Frequency Comments: Density: 1 per 3800 cubic Meters for Acceptance. IA Comparative is 1 per 38000 cubic Meters. QUALITY: Sampled per Borrow Pit Sampling Guide, Sample size is 5 lb bag, per hectare.
Disposition
Accepted Qty: .000
Pay Adjusted Qty: .000
Removed Qty: .000
Checked by Sample:
Forward
Void
Authorize
Auto Generate
Test Formats
Test Results
Ready
Start
Manuals
borrowpitmanualrevised7...
HiCAMS - [Train]
8:42 AM

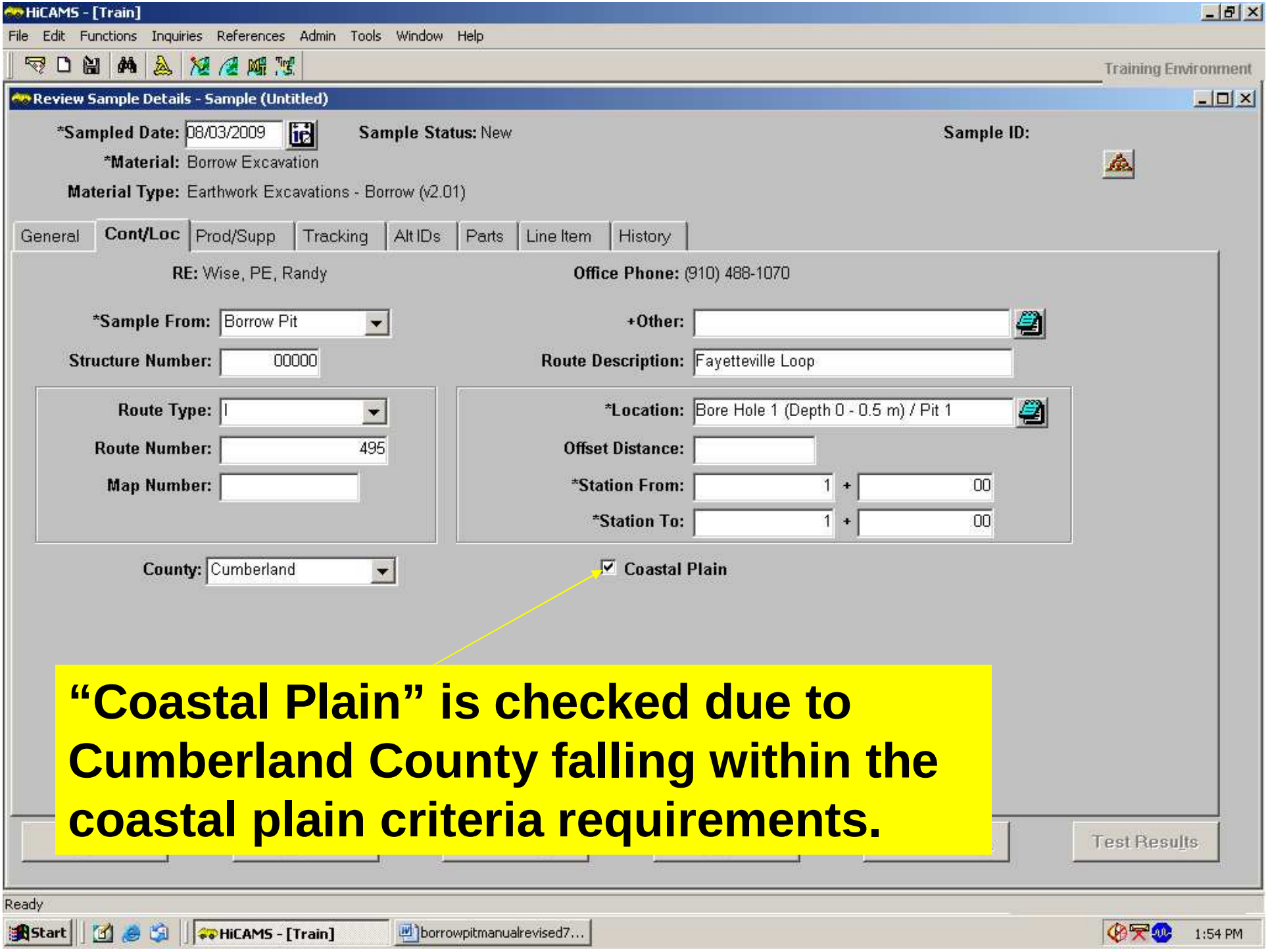


Step 7 Select the "Cont/Loc" tab and enter sample information



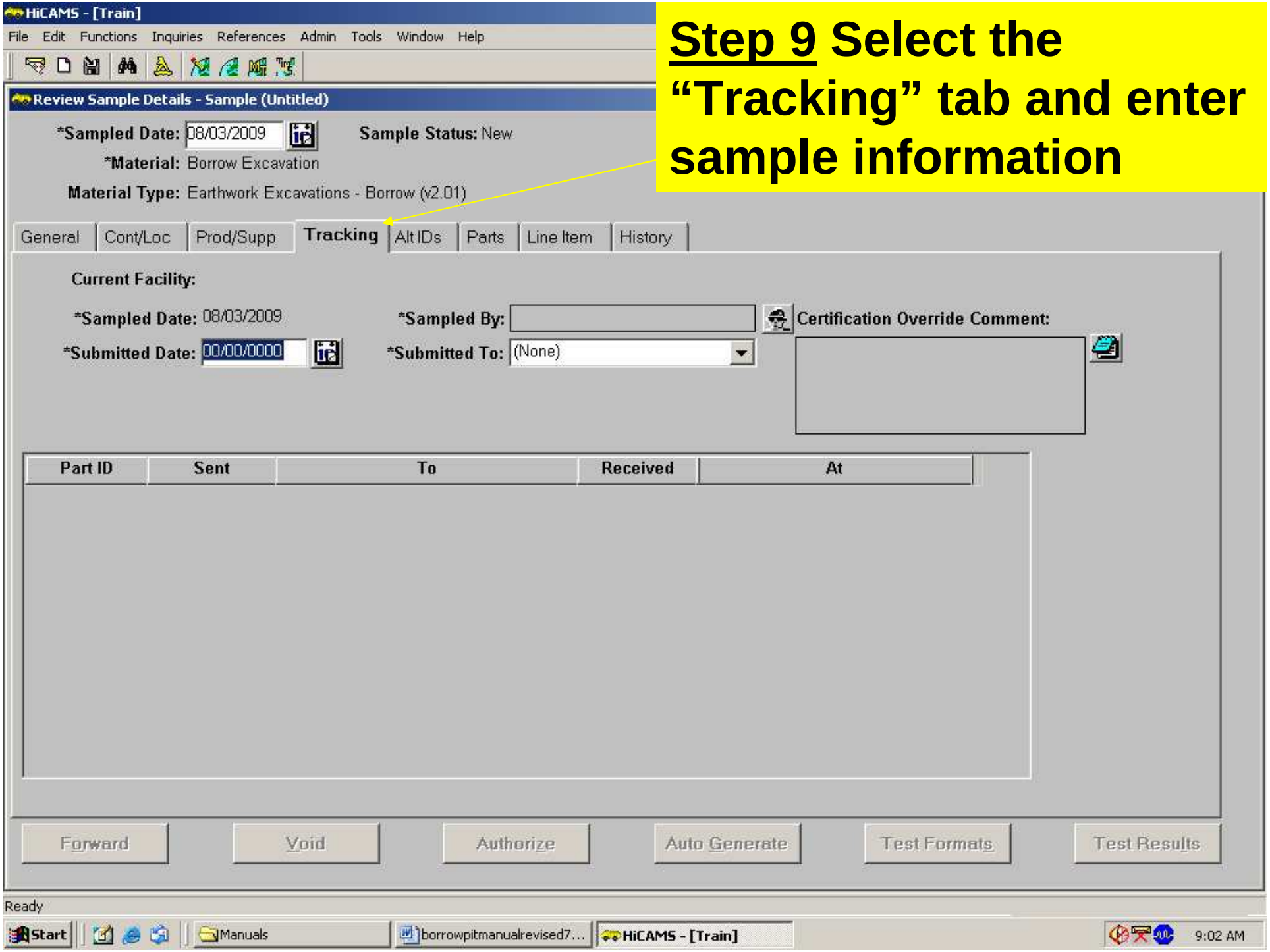
<u>Step 8</u> Note: this project has more than one borrow pit as indicated in the "Location" entry window. The approximate depth from which the soil sample was obtained is also listed in the "Location" window.


HiCAMS - [Train]
File Edit Functions Inquiries References Admin Tools Window Help
Training Environment
Review Sample Details - Sample (Untitled)
*Sampled Date: 08/03/2009
Sample Status: New
Sample ID:
*Material: Borrow Excavation
Material Type: Earthwork Excavations - Borrow (v2.01)
General Cont/Loc Prod/Supp Tracking Alt IDs Parts Line Item History
RE: Wise, PE, Randy
Office Phone: (910) 488-1070
*Sample From: Borrow Pit
+Other:
Structure Number: 00000
Route Description: Fayetteville Loop
Route Type: I
Route Number: 495
Map Number:
*Location: Bore Hole 1 (Depth 0 - 0.5 m) / Pit 1
Offset Distance:
*Station From: 1 + 00
*Station To: 1 + 00
County: Cumberland
Coastal Plain
If station(s) are provided, enter into “Station” windows.
Forward
Void
Authorize
Auto Generate
Test Formats
Test Results
Ready
Start
HiCAMS - [Train]
borrowpitmanualrevised7...
1:54 PM

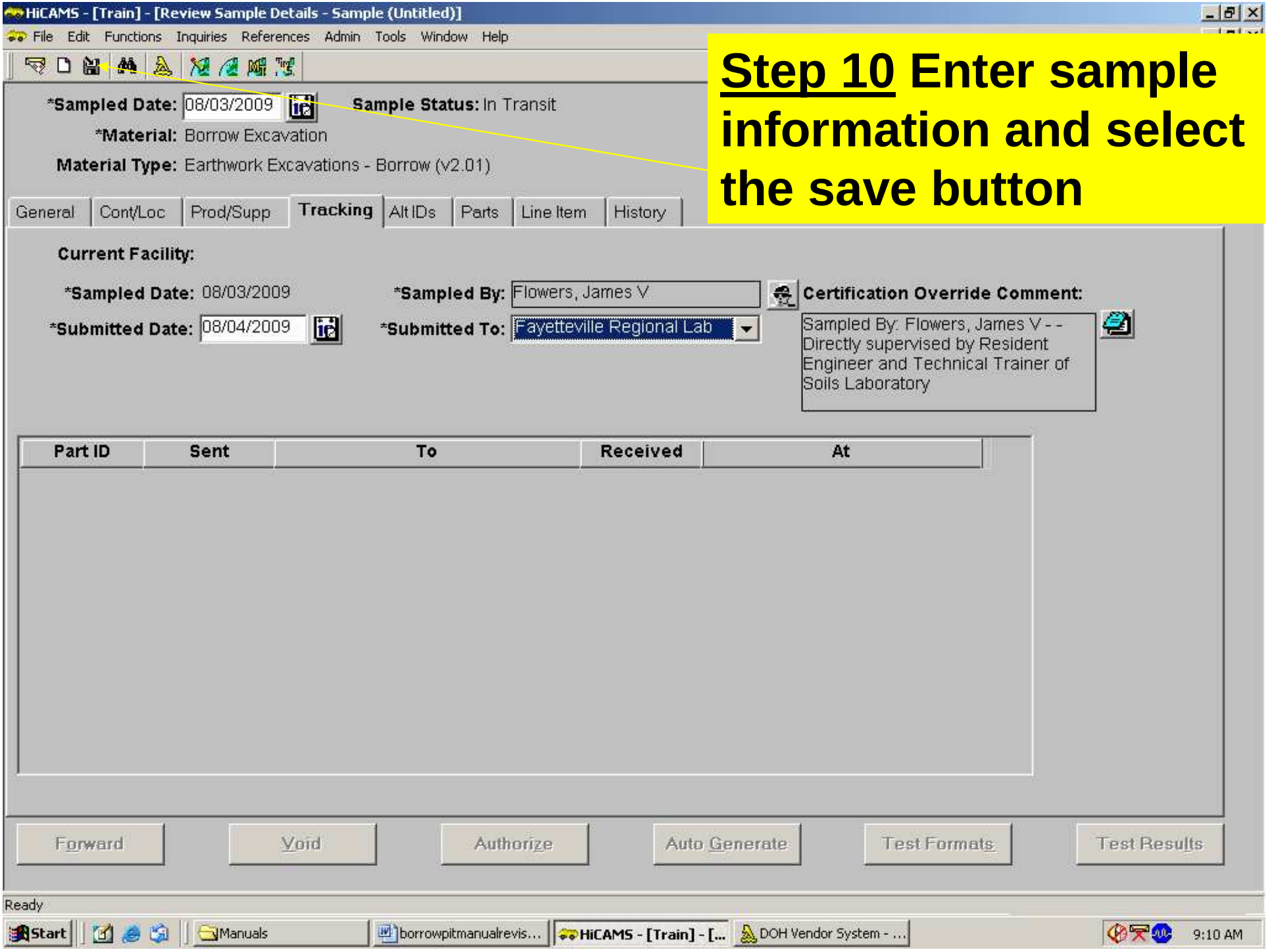


“Coastal Plain” is checked due to Cumberland County falling within the coastal plain criteria requirements.

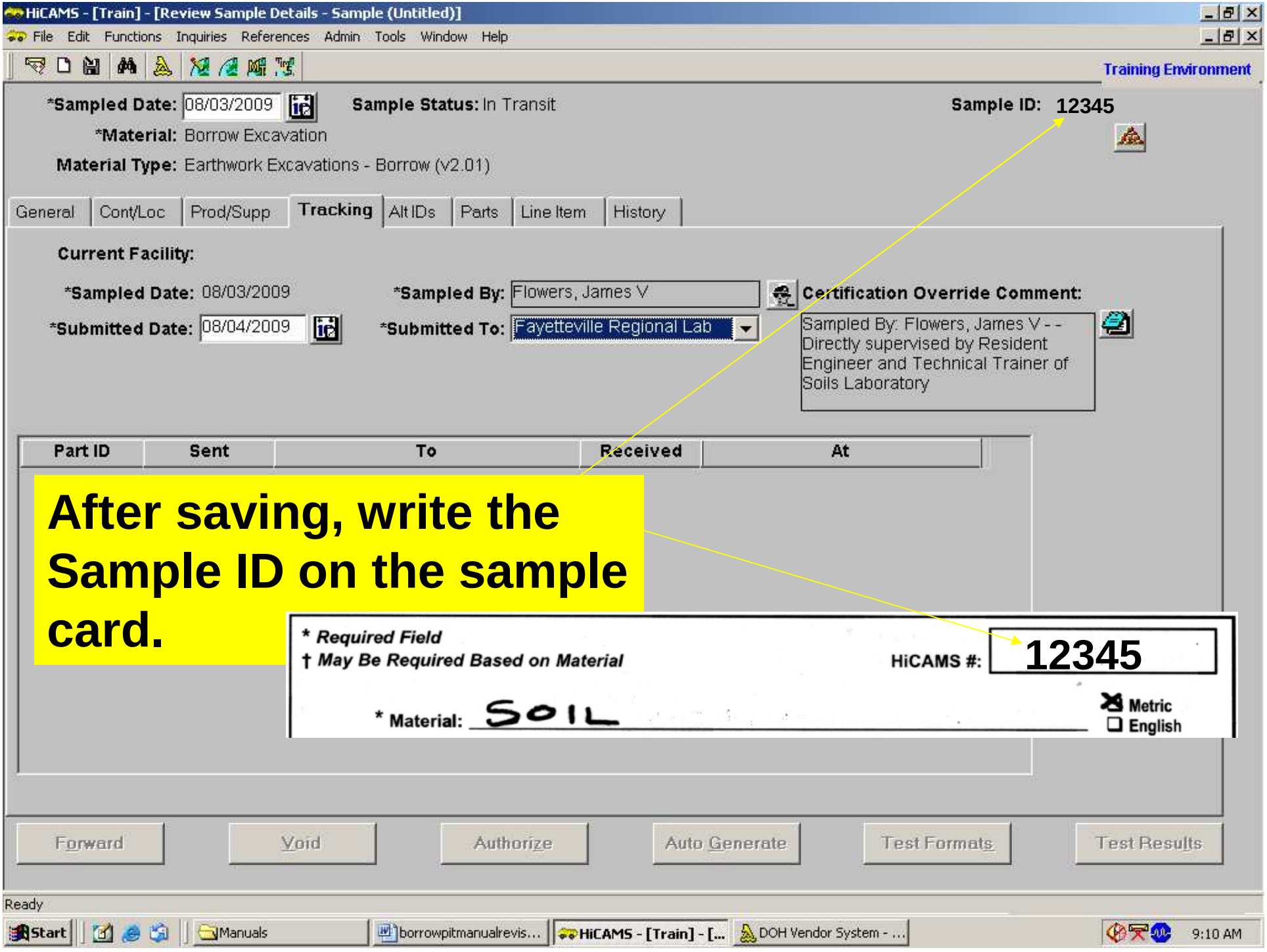
- Refer to Section 1018 Borrow Material in the **NCDOT Standard Specifications for Roads and Structure** to determine if the proposed borrow pit meets statewide or coastal plain criteria.



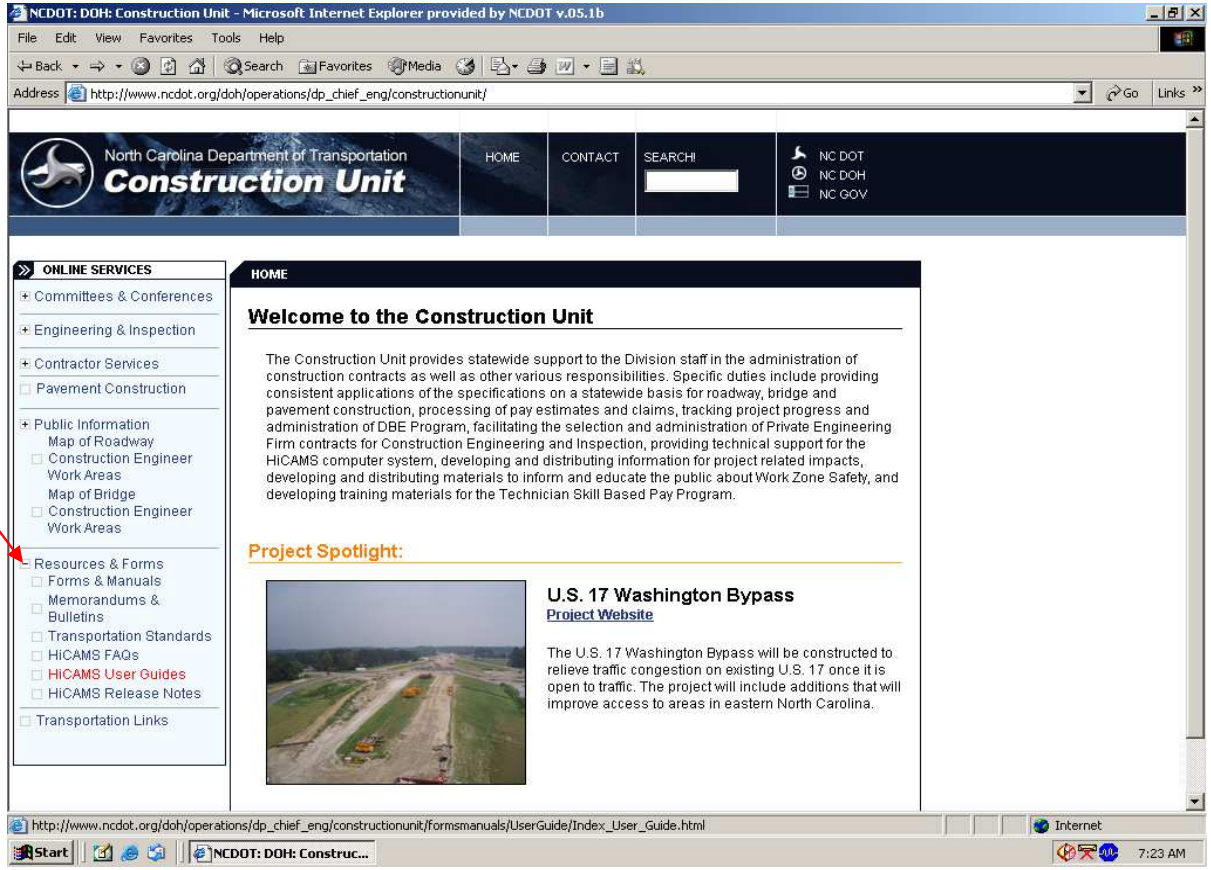
Step 9 Select the "Tracking" tab and enter sample information



<u>Step 10</u> Enter sample information and select the save button


HiCAMS - [Train] - [Review Sample Details - Sample (Untitled)]
File Edit Functions Inquiries References Admin Tools Window Help
Training Environment
*Sampled Date: 08/03/2009
Sample Status: In Transit
Sample ID: 12345
*Material: Borrow Excavation
Material Type: Earthwork Excavations - Borrow (v2.01)
General Cont/Loc Prod/Supp Tracking Alt IDs Parts Line Item History
Current Facility:
*Sampled Date: 08/03/2009
*Sampled By: Flowers, James V
Certification Override Comment:
*Submitted Date: 08/04/2009
*Submitted To: Fayetteville Regional Lab
Sampled By: Flowers, James V - - Directly supervised by Resident Engineer and Technical Trainer of Soils Laboratory
Part ID
Sent
To
Received
At
After saving, write the Sample ID on the sample card.
* Required Field
† May Be Required Based on Material
HiCAMS #: 12345
* Material: SOIL
Metric
English
Forward
Void
Authorize
Auto Generate
Test Formats
Test Results
Ready
Start
Manuals
borrowpitmanualrevis...
HiCAMS - [Train] - [...
DOH Vendor System - ...
9:10 AM

- Since the HiCAMs database is changed periodically, personnel responsible for entering data into the system should monitor the Construction Unit's website for updates. The information can be found under the "Resources & Forms" Section.



- The Materials and Tests website can also provide information relating to HiCAMs.

Technical Training Staff Map

- **David Dunn – Div. 1, 2, 4, 5 (252) 792-1405**
- **Kevin Blalock – Div. 3, 6, 8 (910) 893-6807**
- **Johnny Gilliam – Div. 5, 7 (919) 329-4150**
- **Scotty Jarman – Div. 9, 10, 12 (704) 289-1330**
- **J.J. Myers – Div. 11, 13, 14 (336) 679-8142**